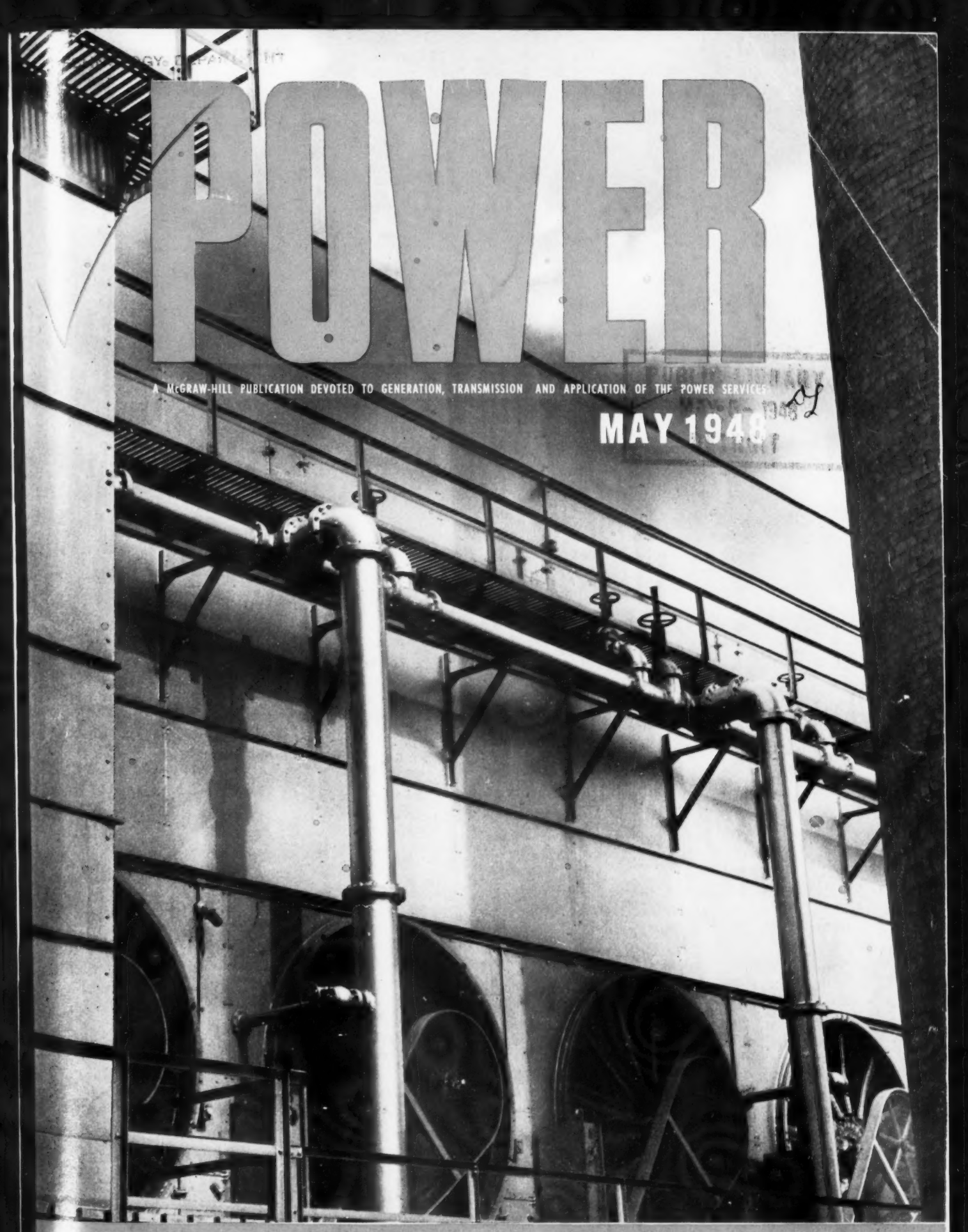


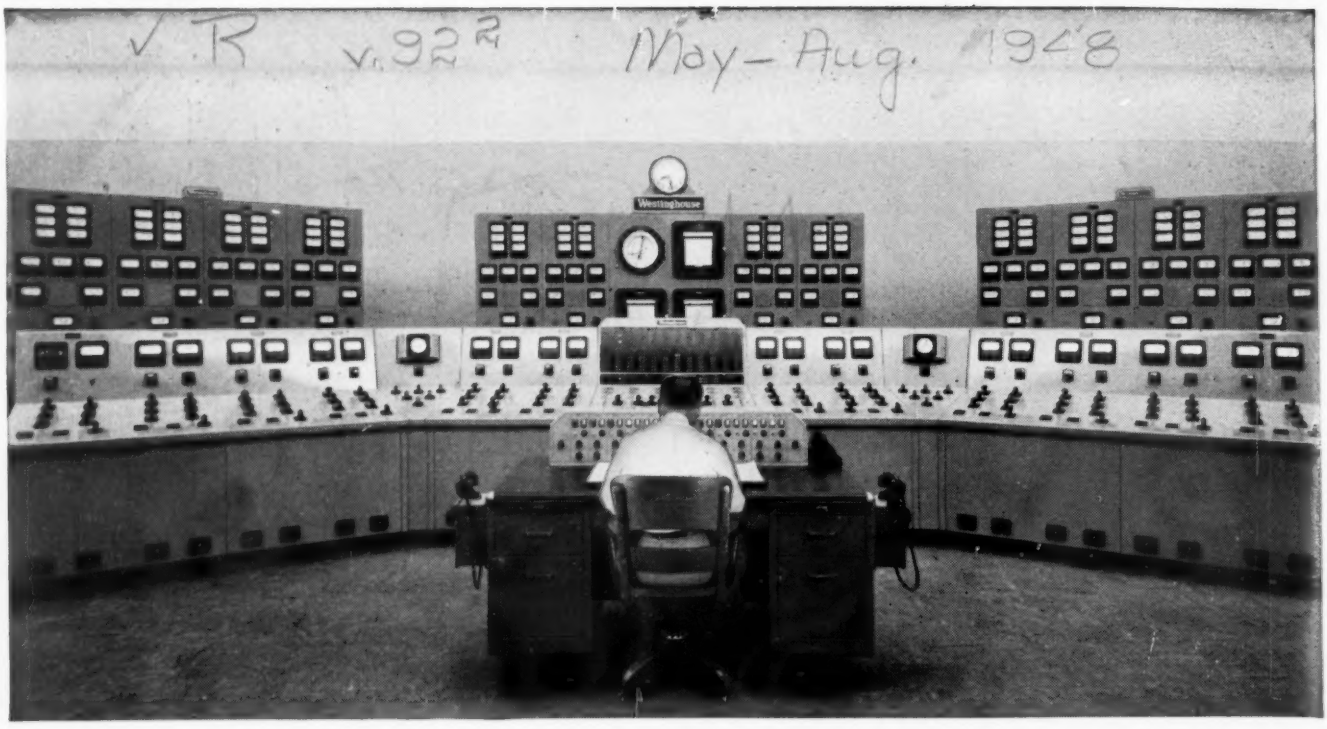
POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

MAY 1948

IN THIS ISSUE: Is the atom job being done? What progress has AEC made in discharging its tremendous responsibilities? For the most complete and clear report on the entire atomic energy program yet made available to outsiders, see p 64. New application of radiant heating prevents floor breaks in freezing rooms, p 91. Liquid rheostats give smooth speed control for wound-rotor motors; for application data, see p 80. **TABLE OF CONTENTS, p 59**

✓R v.92² May-Aug. 1948



Switchboard in Control Room of Aluminum Co. of Canada's Shipshaw Powerhouse. Note how signal lights and Micromax Recorders are centralized in operator's triangle of vision, with all switches for the Station's hydro-generators at the sides.

SHIPSHAW OPERATOR

Watches Generators via Micromax Recorders

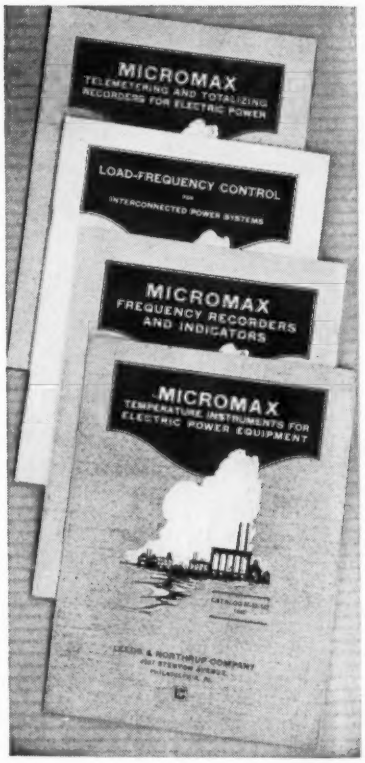
The instruments in Shipshaw Powerhouse's Operating Room are noteworthy for the quick, compact way in which they enable the generation operator to watch the Station's three interrelated conditions of frequency, load and generator temperature.

The Round-Chart Micromax Recorder, just below the clock at the left, shows the frequency.

Beside the Round-Chart Frequency Recorder is a Micromax Strip-Chart Load Recorder. This instrument totalizes the megawatt output of Shipshaw's twelve units.

Below the Frequency and Load Recorders are two Micromax six-point Generator Temperature Recorders; only the top halves are visible in the photograph. Each shows the stator temperatures in 6 generators, and warns if the ultimate load-limit is reached, regardless of power factor, ambient temperature or any other contributing factor.

Thus the four Recorders tell the story of what the twelve turbo-generators are doing, and tell it in the way best calculated to help the operator perform his twin duties of carrying the station load and protecting the machines. Leeds & Northrup Co., 4910 Stenton Ave., Philadelphia 44, Pa.



Any or all of these L&N Publications will be sent on request, but if you have a problem to which an L&N Recorder or Controller may be applied, we suggest you call in an L&N engineer for specific recommendation.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl Ad N-161(7)

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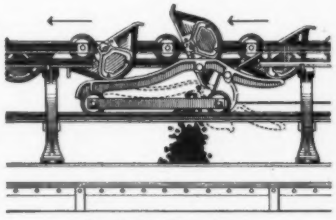
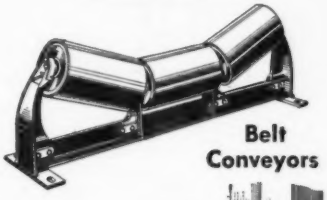
TECHNOLOGY DEPARTMENT

LINK-BELT EQUIPMENT

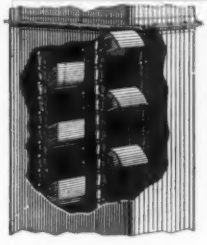
Meets Every Need of Industry in Handling Coal and Ashes



Bucket Carriers



Belt Conveyors



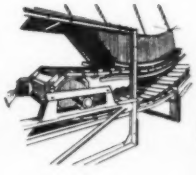
Bucket Elevators

Bulk-Flo

Screw Conveyor

Skip Hoist

Coal Crusher



Feeders

Car Dumper

Weigh Larry

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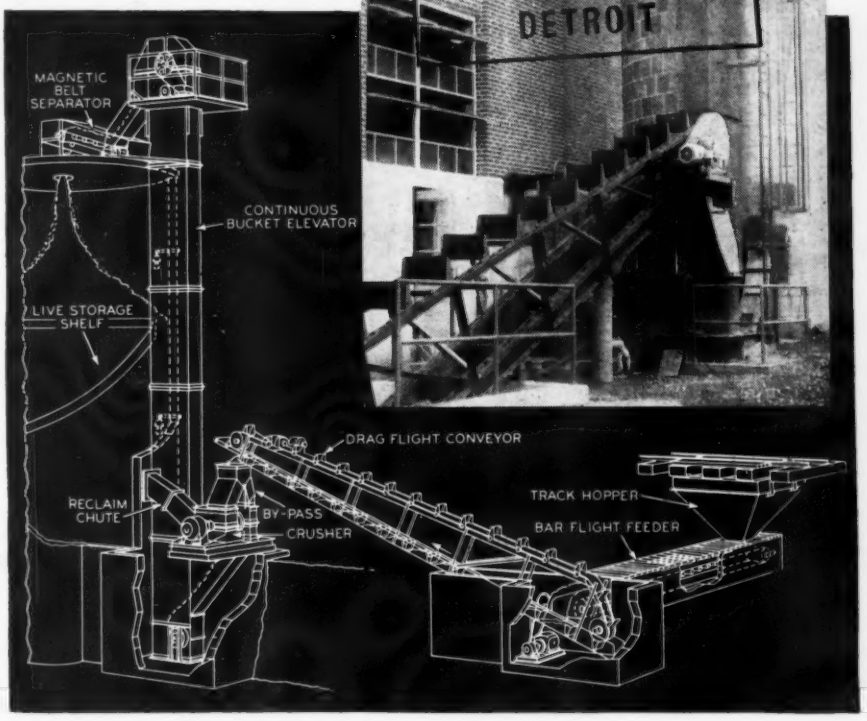


Flight Conveyor-Crusher-Bucket Elevator System Simplifies Coal Handling at Pepperell

Another example of the effectiveness of a Link-Belt integrated system of standardized units is afforded by the coal handling layout at Pepperell Mfg. Co. at Opelika, Alabama.

As illustrated by the diagram and photo above, the operation is as follows: coal from track hopper is delivered by bar flight feeder to drag flight conveyor that empties into chute of coal crusher. The crushed coal is elevated to top of silo by a continuous bucket elevator, discharging to belt conveyor with magnetic pulley, that delivers the crushed coal to live storage part of silo. From live storage, coal is chuted to scales and pulverizer (inside plant). A by-pass chute from drag flight conveyor permits sized coal to by-pass the crusher. A chute from the dead storage section is provided to reclaim coal from this part of the silo.

Let us consult with you on your coal and ashes handling and equipment problems.

LINK-BELT COMPANY

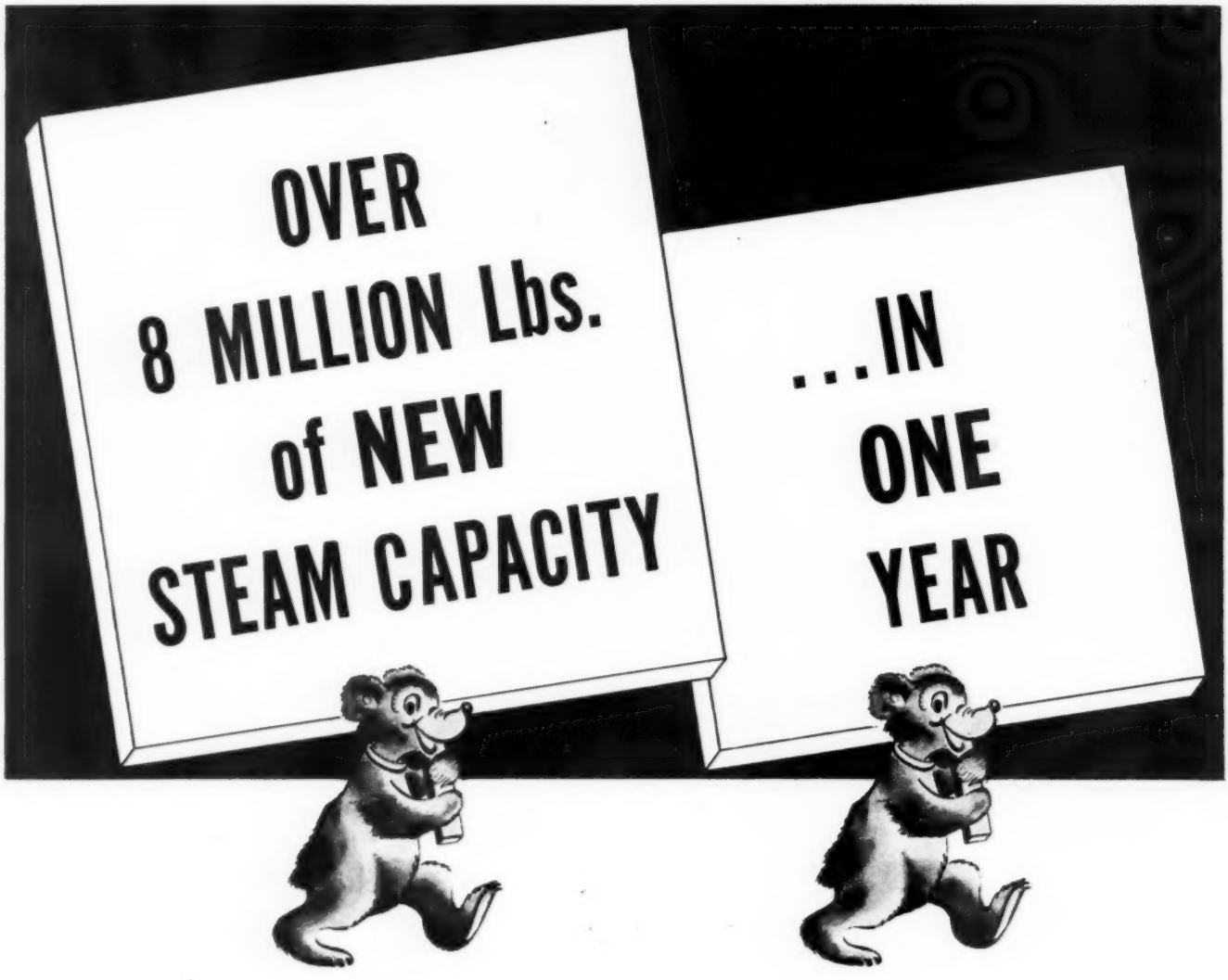
Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

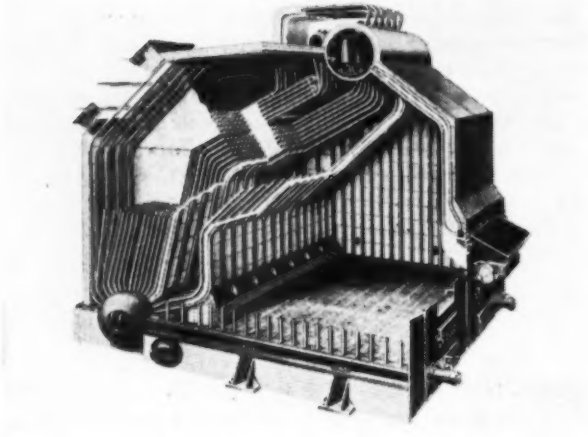
LINK-BELT

THE SYMBOL OF QUALITY — LB — LINK-BELT

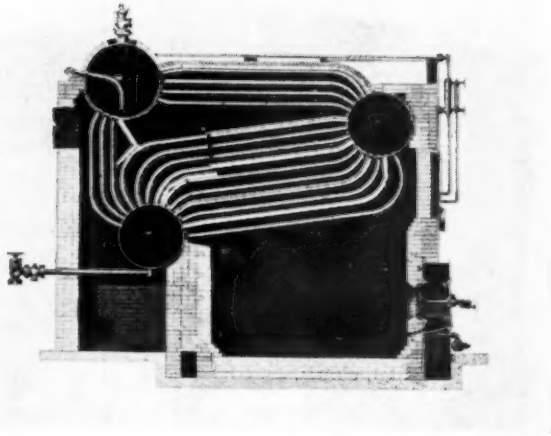
COAL AND ASHES HANDLING EQUIPMENT

11,005





B&W Integral-Furnace Boiler, Type FF with completely water-cooled furnace, for high duty power and process services.



Type H Stirling Boiler usually for low-headroom installations where oil-refractory furnaces are suitable; water cooling may be added.

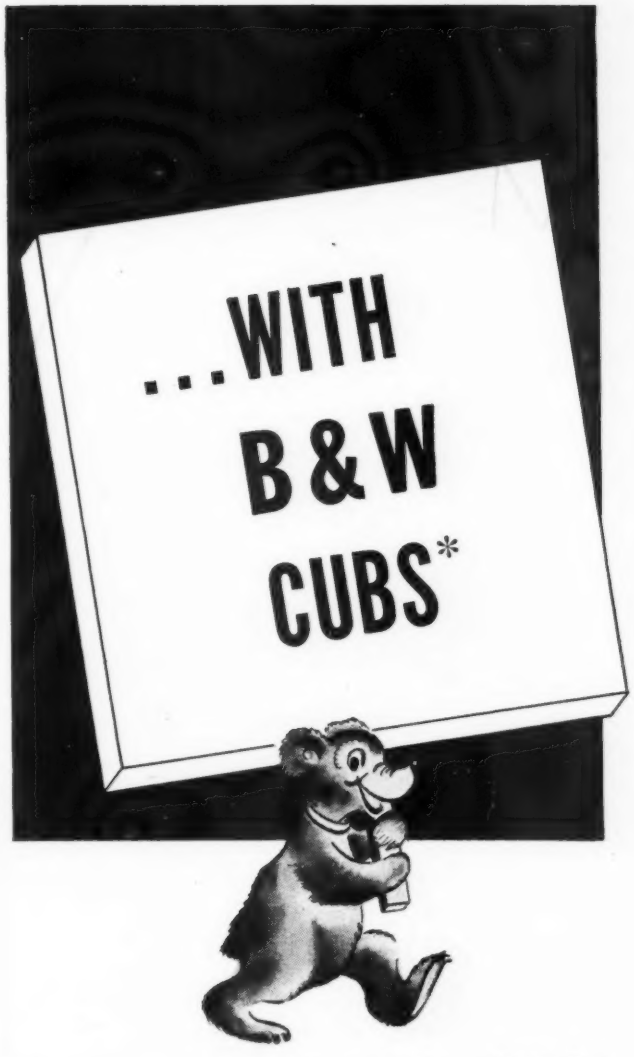
ALL are fully coordinated, flexible units—from fuel burning equipment to breechings and stacks—built and installed under undivided responsibility.

ALL are time-tested, performance-proved units of simplified design and standardized manufacture.

ALL fully meet modern requirements as to fuel flexibility, compactness, ease of operation, fast-steaming and ability to take sudden load swings.

ALL sustain high operating efficiency over their wide range of output, and generate steam of satisfactory quality at all ratings.

ALL have provision for adding superheaters.

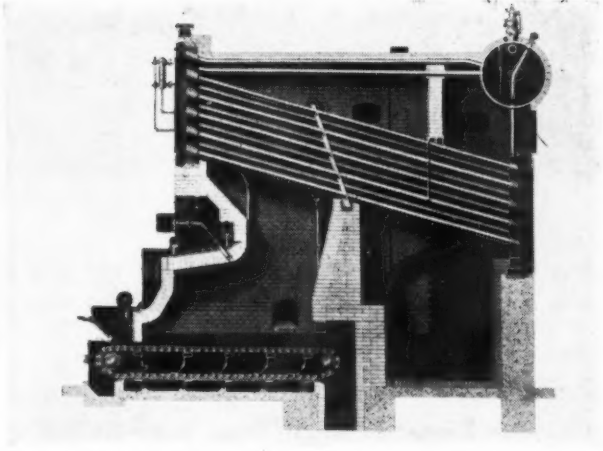


How well the B&W CUBS* fit into present-day power plans calling for boiler capacities up to 60,000 lb. per hr. at pressures above 160 psi. is clearly reflected in the current heavy, industry-wide demand for these three complete, compact units. Through the twelve month period up to March 1, they were ordered at the average rate of *more than one every working day!* Steam capacity of over 8,000,000 lb. per hr. will be provided by these new CUBS* for power, heating and process requirements in a wide variety of commercial, industrial and utility plants throughout the United States, and in 18 foreign countries.

Why are the B&W CUBS* so outstandingly popular? Because all three types fully satisfy industry's requirements for complete, compact, coordinated, boiler units—because all three have impressive records for giving the high standards of performance, continuity of service and long-term economy so essential to dependable, low-cost steam generation, year after year.

***Complete Unit BoilerS**

Each as much a package boiler as *any* unit its capacity can be.



B&W Design 32 Boiler for low-headroom installations where simplicity of straight-tube type is desired.

ALL embody design, construction and operating features that account for the heavy preference for larger B&W boilers for central stations and large industrial applications.

BABCOCK & WILCOX

G-394 T

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ELLIOTT-*Buchi* TURBOCHARGERS

boost power 50% and more on 4-cycle engines, 250 hp and up. They're the modern way to obtain full capacity with less floor space and weight. Driven by the Diesel exhaust, they provide full combustion, better scavenging, greater overload capacity, quicker starting and lower fuel cost per kw.

For these good reasons of economy and performance standards, more and more Elliott-Buchi turbocharged Diesel installations are appearing in rail, stationary and marine fields.

Elliott

ELLIOTT *Fabri-Steel* GENERATORS

lift Diesel performance to new heights by teaming up especially well with the engine and insuring a maximum of killowatts with a minimum of maintenance. These generators are designed and built in accordance with the new Elliott Fabri-steel principles of welded steel frame and rotor, with silver brazed damper winding joints and, on larger machines, edge-wound copper ribbon rotor field windings. They are fast making friends everywhere with Diesel engines of all makes — on countless applications.

Q-1135

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EXPANDERS • TUBE CLEANERS • STRAINERS • FILTERS

Diamond Soot Blowers

TO SUIT YOUR INDIVIDUAL NEEDS

AIR CLEANING

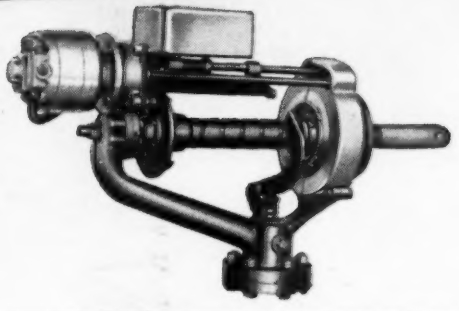
TYPE OF OPERATION	TYPE OF CONTROL
AIR ELECTRIC MANUAL	AIR ELECTRIC AIR-ELECTRIC MANUAL

STEAM CLEANING

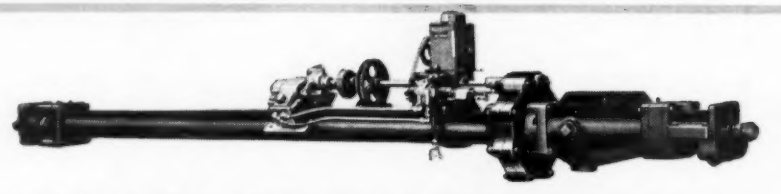
TYPE OF OPERATION	TYPE OF CONTROL
AIR ELECTRIC MANUAL	AIR ELECTRIC AIR-ELECTRIC MANUAL

DIAMOND
MODEL IR
Short Retracting Soot Blower

For cleaning furnace walls or boiler heating surfaces where gas temperatures exceed limit for permanently installed units. Equally applicable to compressed air or steam as a cleaning medium. Manual, air, or electric operation. Advantages include: positive poppet type valve, 12" travel, no lubrication, simple construction, exceptional durability, etc.

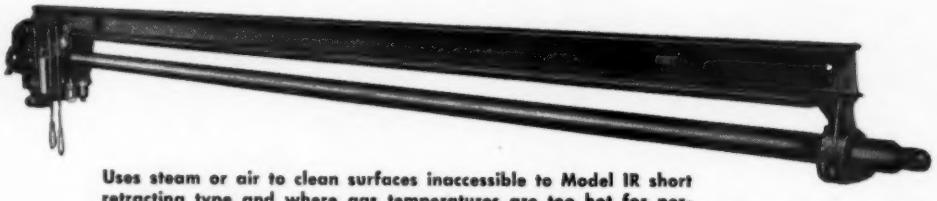


DIAMOND
TELESCOPIC
Long Retracting Soot Blower



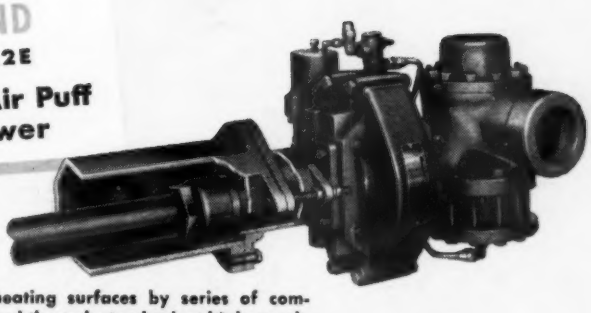
Used where insufficient clear space outside boiler will not permit installation of Model IK retracting blower for cleaning surfaces inaccessible to short retracting blower and where gas temperatures are too hot for permanently installed units. Uses air or steam as cleaning medium. Either electric or air operation.

DIAMOND
MODEL IK
Long Retracting Soot Blower



Uses steam or air to clean surfaces inaccessible to Model IR short retracting type and where gas temperatures are too hot for permanently installed soot blowers. Three standard sizes have travels of 10', 12' and 16'; also special travels up to 20'. Either air or electric operation.

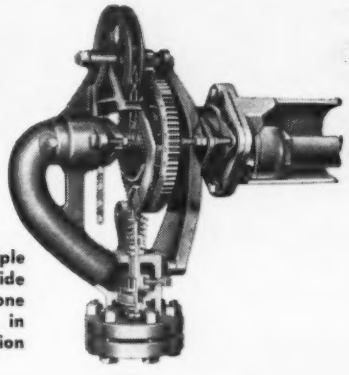
DIAMOND
MODEL A2E
Automatic Air Puff Soot Blower



Automatically cleans heating surfaces by series of compressed air puffs delivered through standard multiple nozzle blowing element. Spreading cleaning cycle over longer time permits smaller compressor and receiver . . . also eliminates stack discharge nuisance.

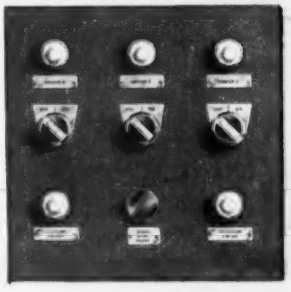
Master Controller automatically controls blowing time and sequence. Just a "twist of the wrist" to open valve . . . controller does rest. Automatic control assures correct boiler cleaning and no labor is needed.

DIAMOND
MODEL G9B
Soot Blower



Uses steam as cleaning medium through multiple nozzle blowing element permanently installed inside setting. "Automatic Valved" requiring only one continuous operation to open and close valve in head and simultaneously rotate element. Operation is manual, air or electric.

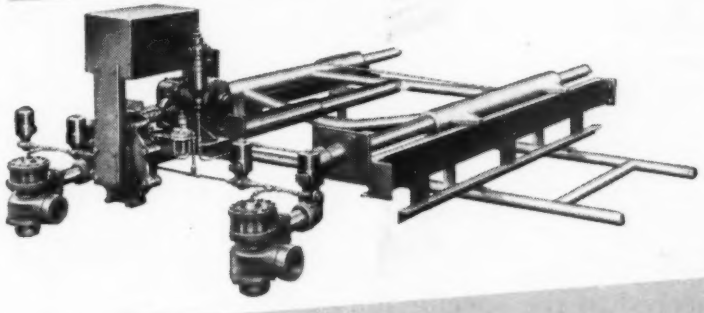
DIAMOND
ELECTRIC
Control Panel



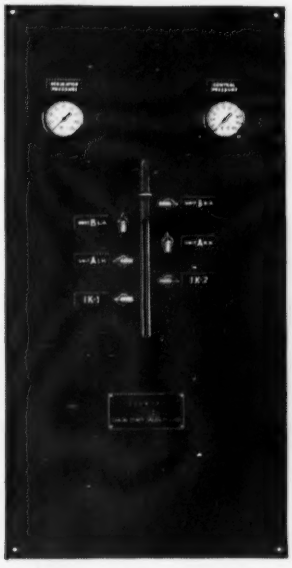
For controlling any combination and number of blowers. All are operated in correct sequence and at right blowing speed by pushing one "start" button.

DIAMOND
AUTOMATIC
Air Heater Blower

One or more multiple nozzle blower elements supported on frame which traverses in straight line across tube sheet. Blowing medium is compressed air discharged intermittently to limit compressor and tank size. Air or electric operation—air or electric control, completely automatic.



DIAMOND
AIR
Control Panel



Can be arranged for controlling any number of blowers or groups of blowers. Correct cleaning is always assured and labor is saved.

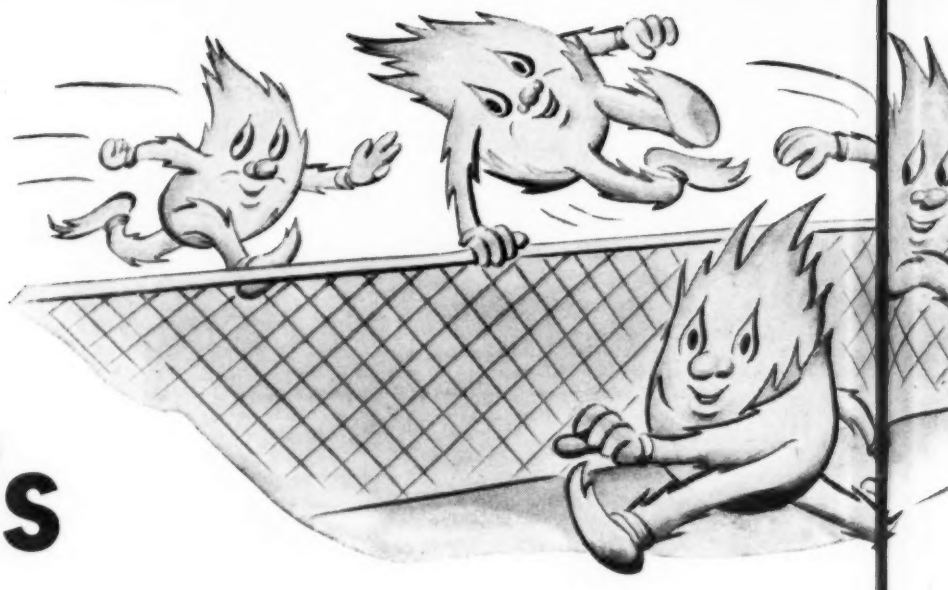
Operating conditions and individual preferences vary so greatly that there is need for wide choice in soot blower types and soot blowing methods.

Diamond offers the greatest choice in both methods and blowers—from simple manually operated steam or air cleaning to Diamond Automatic Sequential Blowing which cleans the boiler completely at the turn of a switch. There is a Diamond combination to do a better cleaning job on any type boiler.

DIAMOND POWER SPECIALTY CORP.

DETROIT 31, MICHIGAN

Diamond Specialty Limited • Windsor, Ontario



Btu's

Every fuel has a large percentage of Btu's ready to "go over the fence". They do no work. They produce no power. The more you can keep on the job—the lower your power costs will be. And that is exactly what the Bailey co-ordinated boiler control system can do for you.

It reduces fuel consumption per pound of steam generated. Combustion, feed water, steam temperature, heater levels, pump speeds and all other factors are co-ordinated—automatically controlled. With Bailey Controls safety of operation is increased—continuity of service is improved. You convert the maximum number of Btu's into power. You get full efficiency from your boiler.

Many Bailey co-ordinated boiler control systems have paid for themselves in fuel saved in less than one year. All do not return their original cost as quickly as this. But the quick way to find out how Bailey boiler control will work for you is to talk to one of our engineers. Bailey co-ordinated boiler control is not a package unit. Each must be engineered to the specific job.

If you are looking for low cost power, it will pay you to call our nearest office.

A-105-1

BAILEY METER COMPANY
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BAILEY METER COMPANY LIMITED, MONTREAL, CANADA

BAILEY METERS

Controls for Steam Plants
COMBUSTION • FEED WATER • TEMPERATURE
PRESSURE • LIQUID LEVEL • FEED PUMPS

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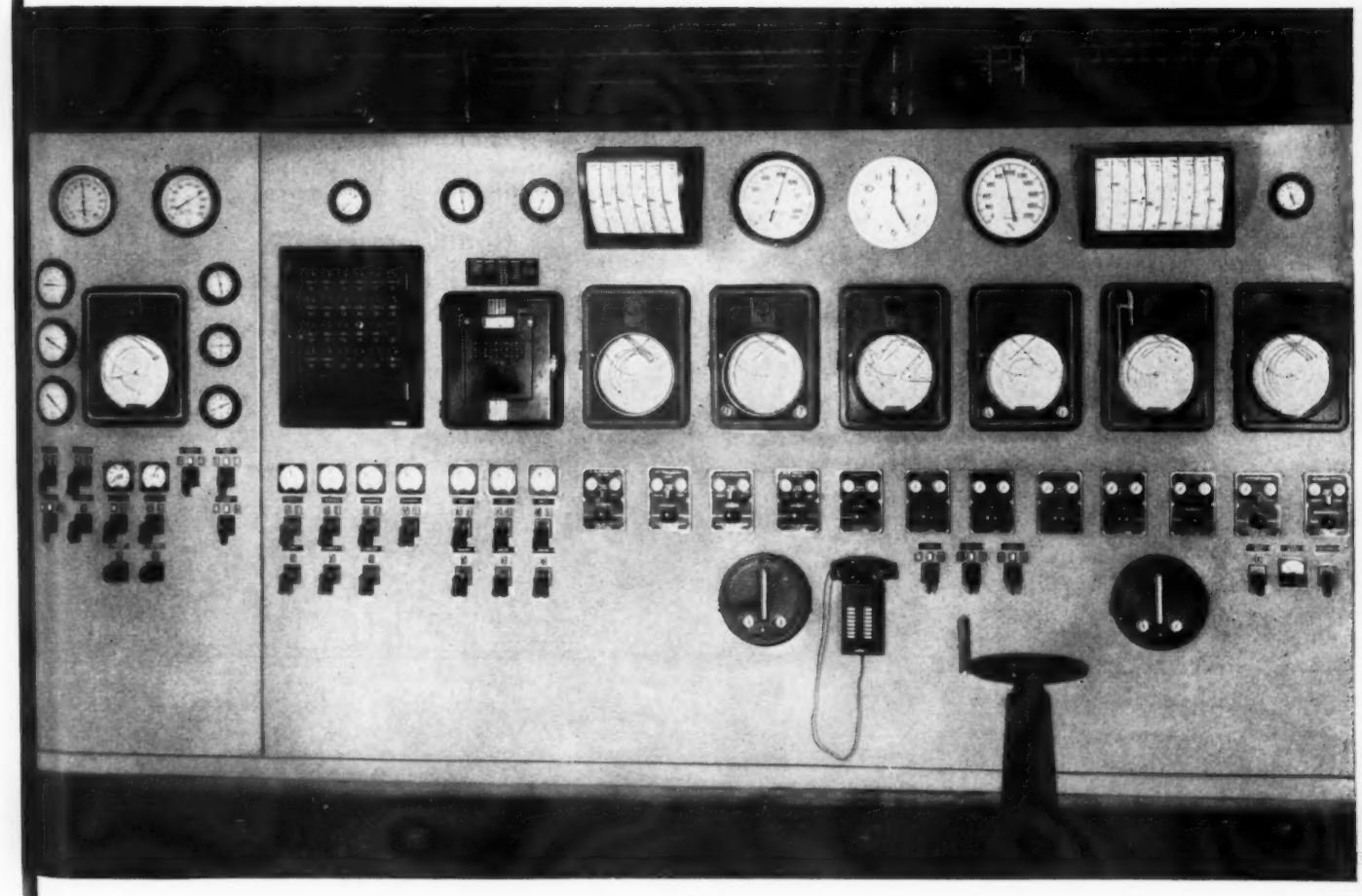
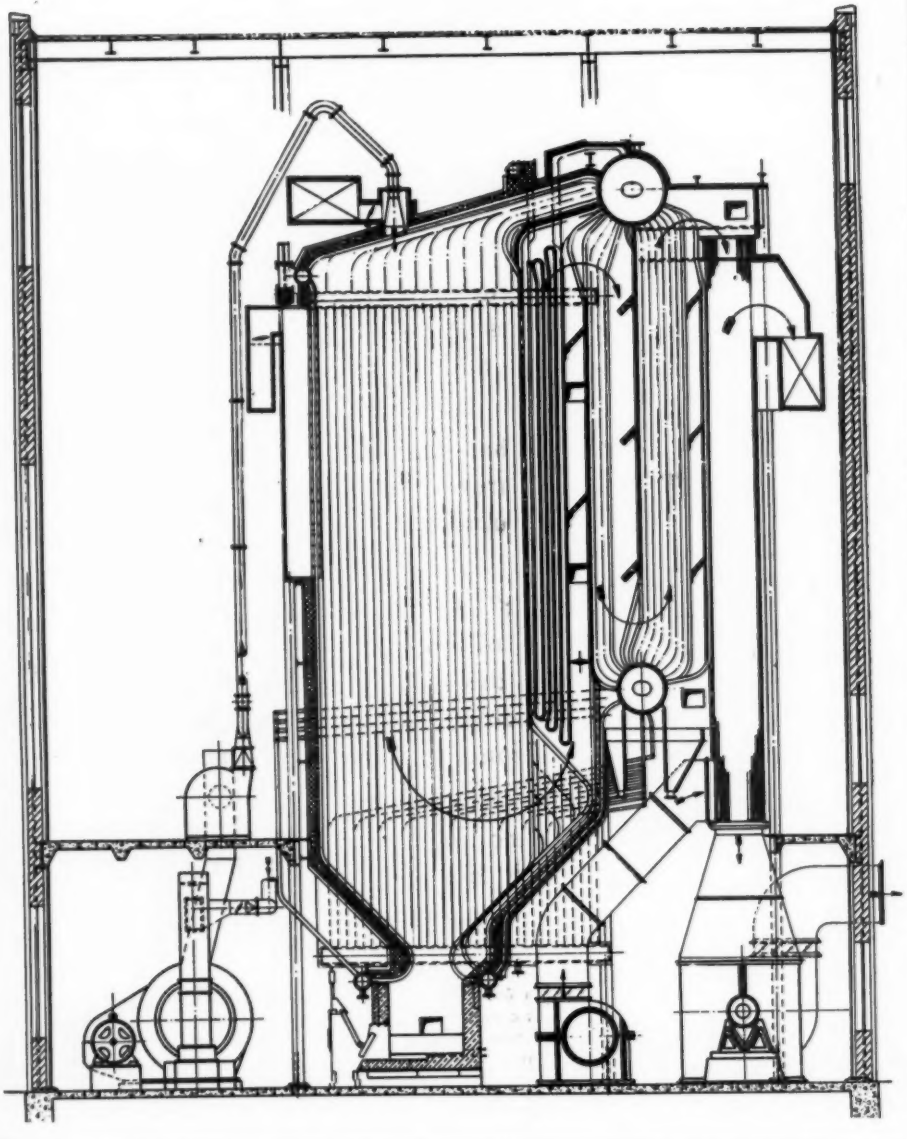


This co-ordinated system of Bailey Combustion and Three-element Feed Water Control prevents Btu's from going a.w.o.l. at Potomac Edison Company, Williamsport, Maryland. The maximum steaming capacity of this 860 psi pulverized coal fired boiler is 400,000 lbs. per hour.

Chicago, Milwaukee, St. Louis, New Orleans, St. Paul, Kansas City, Houston, Denver, Los Angeles, Seattle, San Francisco

KVS Engineered..



KVS PRODUCTS

BOILERS . . . AIR SWEPT TUBE MILL PULVERIZERS . . .
FANS . . . PREHEATERS . . . SUPERHEATERS . . . ECONOMIZERS . . .
WATER WALLS . . . COAL ELEVATORS . . . BUNKERS . . .
ASH CONVEYORS . . . COAL-WEIGHING SCALES

RADIANT HEAT

provides high radiation rate and decreased convection boiler surfaces

Tangent tube rear furnace wall in combination with shadow walls eliminates refractory maintenance between furnace and superheater pass.

This construction permits higher furnace temperatures resulting in greater radiant heat transfer and increased furnace efficiency.

This type of rear wall is a "must" in modern furnace design where low heat release, low fusion temperatures and high ash content coals are to be used. These factors are dependent on superfine pulverization and complete carburization of the fuel.

Large furnace wall headers and increased water supply are required with these high furnace temperatures to insure maximum steam output without endangering the furnace tubes.

We have not featured KVS Air Swept Tube Mills with automatic controls here, because we believe the industry recognizes their superiority.

These and all other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels in order to assure the maximum in operating efficiency and economy at all boiler ratings.

KVS ENGINEERING SERVICE

KVS Steam Generating Equipment has been performance proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

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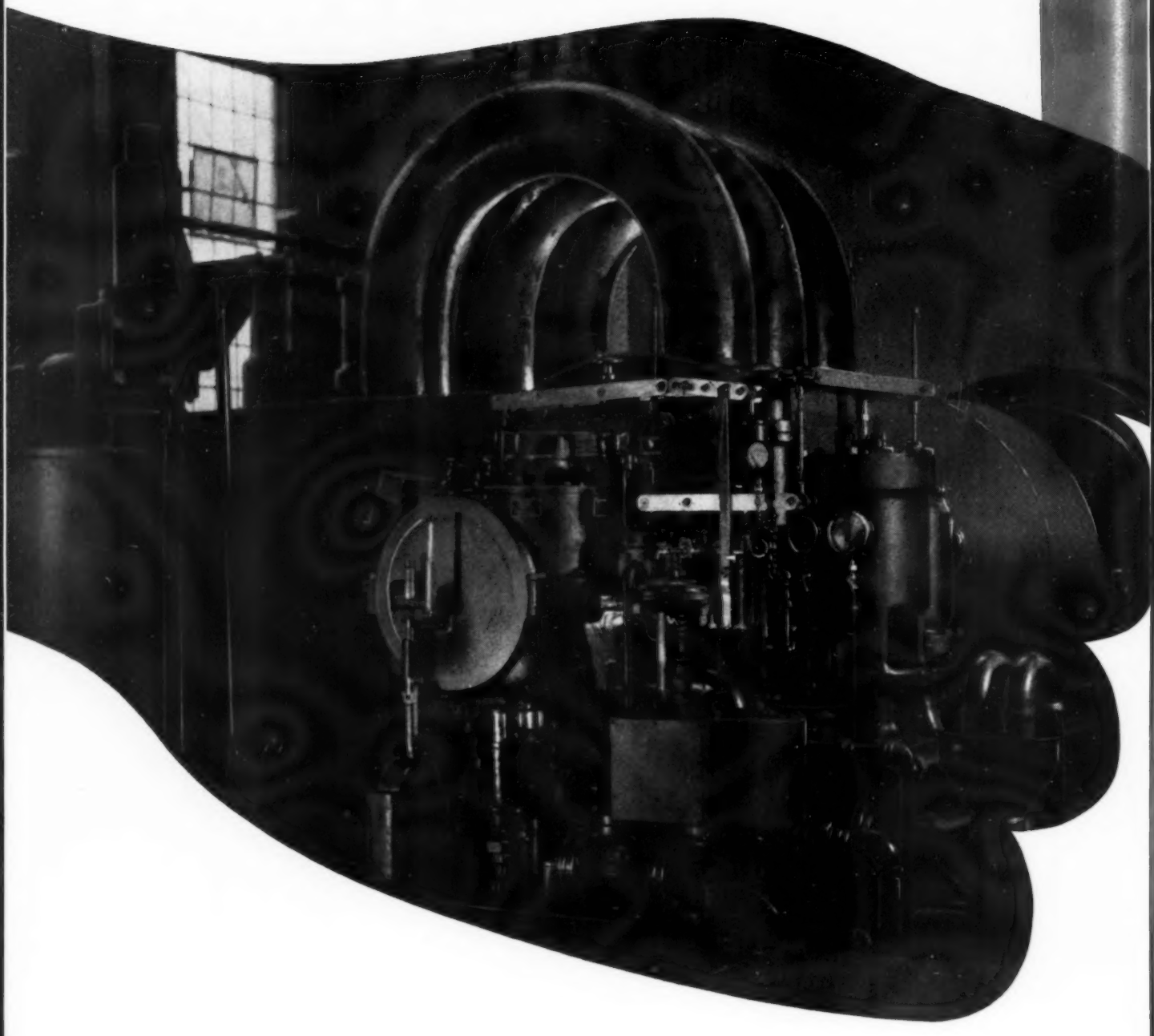


*GUARANTEE

"We guarantee that Nonpareil Turbine Oil, Medium and Heavy, will last as long as your turbine where the lubrication system is thoroughly cleaned before this oil is put into use and where Nonpareil Turbine Oil, Medium or Heavy only, is used for replenishment, and where the temperature of the oil from the bearings is kept below 170° F. This guarantee has no time limit. If at any time, when the oil is operating under the above conditions, the neutralization number should rise higher than the extremely low limit of 0.15 when determined by A.S.T.M. Method D 188-27 T, we will cheerfully replace the oil without additional expense."

TANDARD STANDARD OIL COMPANY (INDIANA)

5 safeguards against outages

NONPAREIL TURBINE OIL

Under varying service conditions, one or all of these turbine oil qualities can bring added dependability to your turbine operation.

1. ***Nonpareil does not form asphaltic deposits.*** Delicate governor parts, oil lines, and bearings stay clean because the refining process removes from the oil all asphaltene-forming hydrocarbons.

2. ***Nonpareil does not increase in acidity*** above 0.15 mg.KOH/gm no matter how long it is left in a turbine. This is *guaranteed** in writing.

3. ***Nonpareil does not need treating, resting or replacing.*** There are no interruptions to turbine operation because of oil deterioration.

4. ***Nonpareil resists foaming.*** It contains an anti-foam additive which prevents oil overflow, eliminating a potential fire hazard or loss of oil.

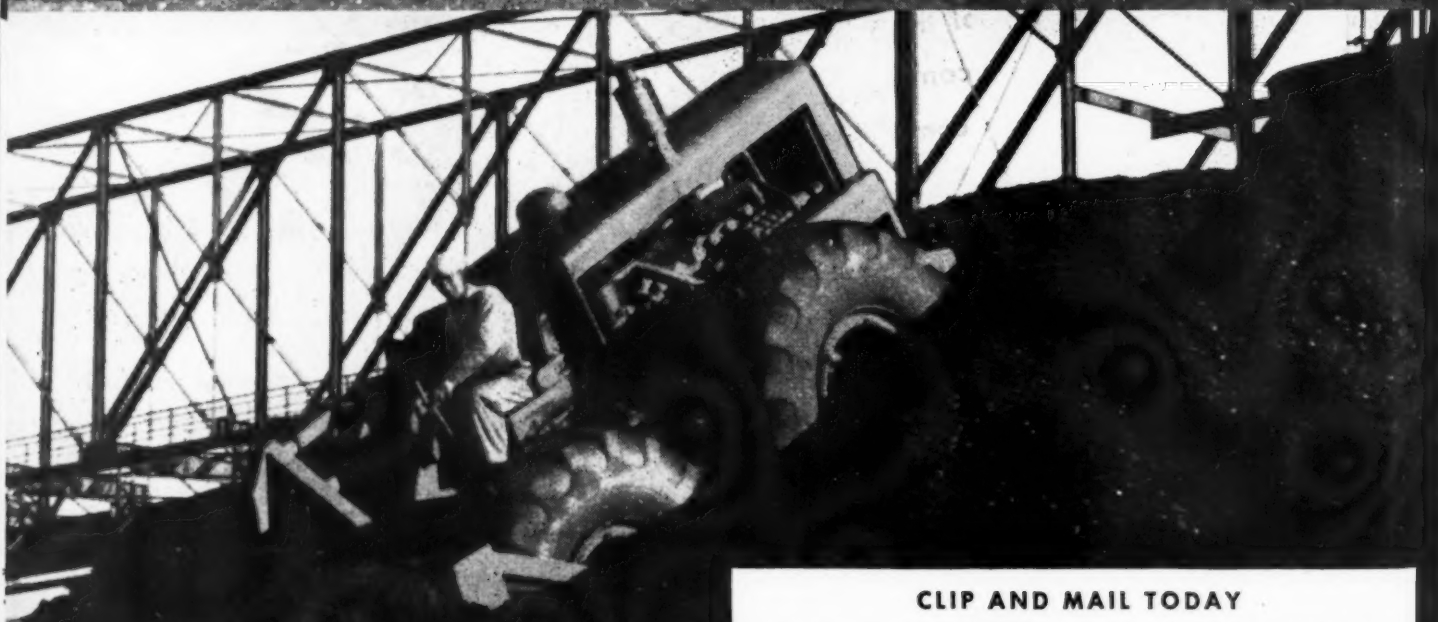
5. ***Nonpareil contains a corrosion inhibitor*** and passes A.S.T.M. D-665-46T test for corrosion resistance.

20 years of operation prove that Nonpareil-lubricated turbines require no outage time for oil system maintenance. You can check this fact with nearby users of Nonpareil. A Standard Oil Lubrication Engineer will give you their names and locations. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois for the nearest Engineer.

STANDARD OIL COMPANY (INDIANA)

STANDARD

Stockpile all the
TOURNAPULLS



CLIP AND MAIL TODAY

R. G. LeTOURNEAU, INC., Peoria, Illinois

Please send information on coal handling equipment for handling approximately.....tons per day.

Name.....**Title**.....

Company.....

Address.....

City.....**State**.....

Type of business.....

coal you need with TOURNADOZERS

Rubber-tired Tournapulls, with coal carrying capacities up to 18 tons, can extend storage area under your present overhead cranes, or haul direct from trackside dump to any stockpile site you have. Pile in compacted layers to any height. Reload coal and dump from ramp to cars, trucks, conveyors or boiler feeders.

Rubber-tired Tournadozers, used to push-load the high-speed Tournapulls can also be used to spread and move coal. Because both of these big coal-handlers ride on giant, low-pressure tires, they compact coal without damage . . . minimize danger of spontaneous combustion.

In addition, these versatile rigs can do excavating work and material handling around your plant. Both Tournapull and Tournadozer go anywhere . . . across tracks, on pavement, cross country. Ready to work when they drive into your gate . . . no delay or cost for erection.

Here is a quick way to get adequate coal storage and insure steady fires under your boilers. See your LeTourneau Distributor or write for full information. Investigate TODAY.

DETROIT PUBLIC LIBRARY

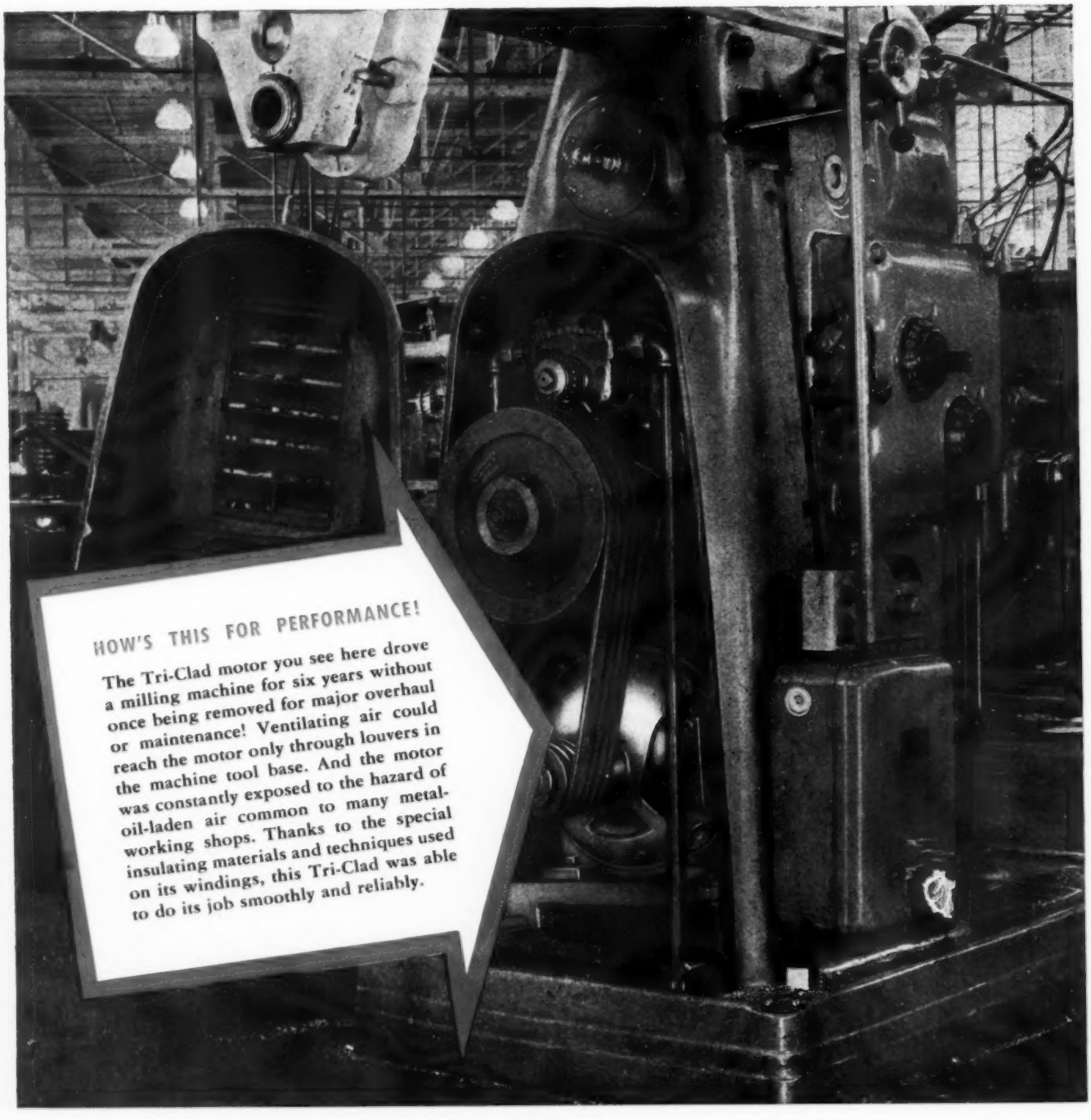
Tournapull—Trademark Reg. U.S. Pat. Off. CH-4
Tournadozer—Trademark

LETOURNEAU LET EQUIPMENT

R. G. LeTOURNEAU, Inc.

PEORIA, ILLINOIS

6 years in



HOW'S THIS FOR PERFORMANCE!

The Tri-Clad motor you see here drove a milling machine for six years without once being removed for major overhaul or maintenance! Ventilating air could reach the motor only through louvers in the machine tool base. And the motor was constantly exposed to the hazard of oil-laden air common to many metal-working shops. Thanks to the special insulating materials and techniques used on its windings, this Tri-Clad was able to do its job smoothly and reliably.

GENERAL ELECTRIC

760-4

"solitary"

prove you can't beat

TRI/CLAD

extra protection

Six years ago, the Bell Aircraft Corp. installed in its Buffalo plant many machine tools which had G-E Tri-Clad motors tucked away inside. Operating in confined quarters where the volume of cooling air was limited (and laden with oil), these sturdy Tri-Clads toiled 24 hours a day, 7 days a week all through the war years. At a time when manpower for motor maintenance was almost unobtainable, these motors proved they had the "stuff" to stay on the job with only the barest amount of attention.

The Tri-Clad family is a big one now! It includes open (dripproof) motors, totally enclosed motors (shown above), gear motors, vertical motors and wound-rotor motors. There's a Tri-Clad for almost every application.

EXTRA PROTECTION IS THE ANSWER!

Installation studies like this prove this important fact—that when there's a tough motor job to be done, you can't beat Tri-Clad extra protection. Over 1,500,000 Tri-Clad motors have been built. All of them feature cast-iron enclosures, improved winding and insulating techniques, and advanced bearing design. All are equipped with *extra protection* against physical damage, *extra protection* against electrical breakdown, and *extra protection* against operating wear-and-tear. That is what "Tri-Clad" means—better motor performance at less cost through maximum motor protection.

THE TOTALLY ENCLOSED TRI-CLAD!

We believe the Tri-Clad totally enclosed induction motor is industry's most dependable motor. It is designed for use in adverse atmospheres—in iron dust, out-of-doors, in hazardous areas, and chemical atmospheres. It is available in both standard and explosion-proof enclosures. Call or write your nearest G-E field office for more information today. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

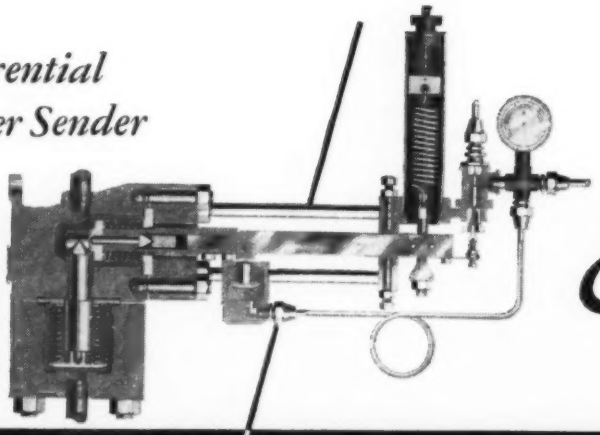
GE

TRI/CLAD

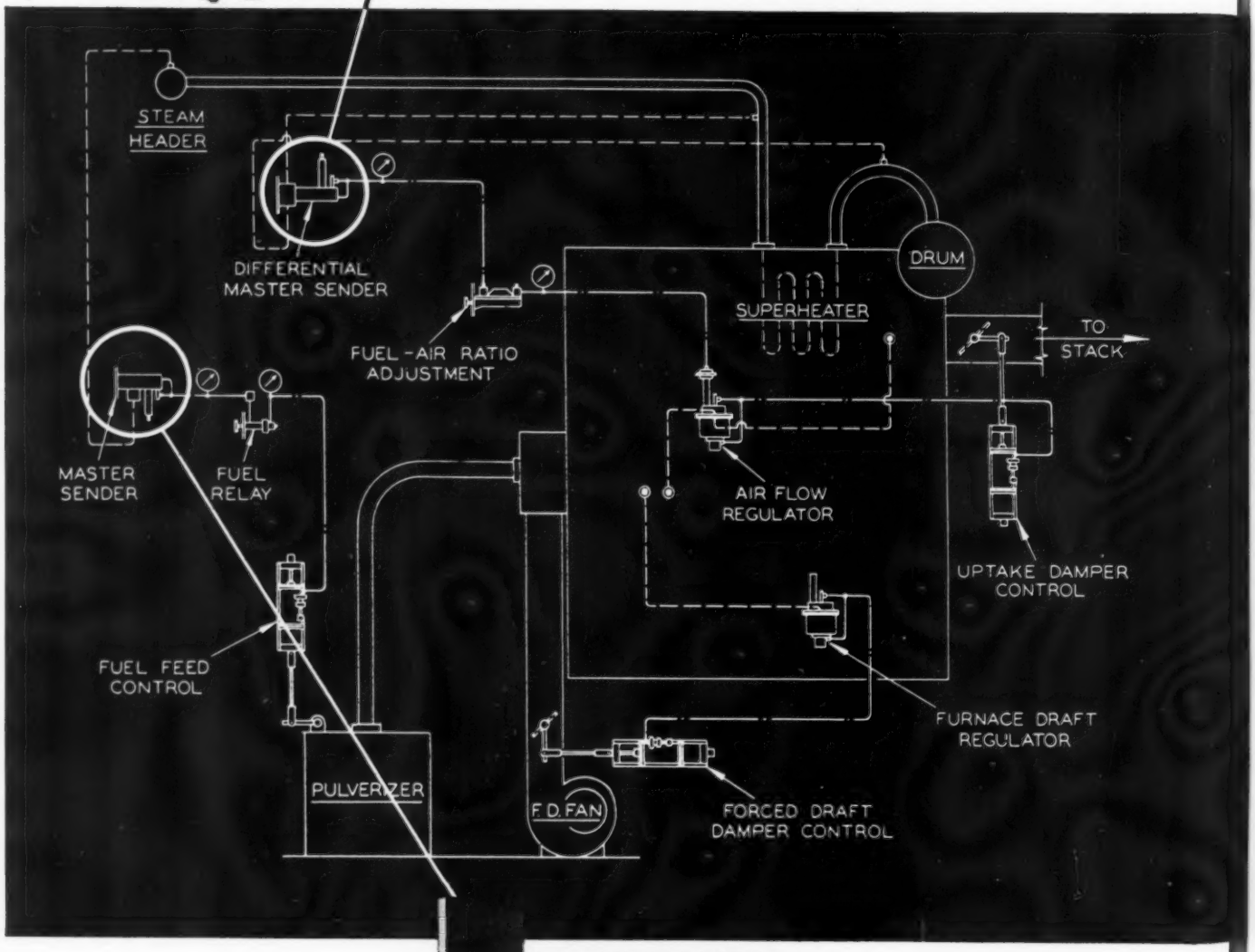
REG U.S. PAT. OFF.

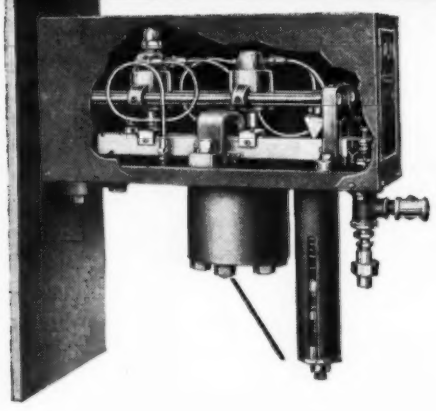
MOTORS

Differential Master Sender



simple...





Master Sender

direct... accurate

the Hagan Differential Master Method of automatic combustion control

IN THE firing of pulverized coal, the accurate maintenance of fuel-air ratio has been hampered by such factors as variation in the calorific value of coal, and variation in operation of coal feed mechanisms which are affected by moisture content and coal size.

The Hagan Differential Master method of combustion control automatically maintains proper combustion conditions in a simple and direct way, using the boiler unit itself as a calorimeter of heat input.

A Master Sender, sensitive to steam header pressure, controls the rate of fuel feed so that B.t.u. input is in accordance with demand.

A Differential Master Sender, measuring steam flow, regulates air flow.

These units are not interconnected; each has its own function, and performs that function *directly.* The rate of fuel feed is changed instantly to compensate for any change in steam demand, or variation in calorific value of fuel or in feeder characteristic. Air, however, is changed only when there is an actual change in steam flow.

Control is direct and accurate—there is no necessity for approximate adjustment, to be corrected by a lagging corrector system.

Tested in Service. The Differential Master method has been thoroughly tested in service. It has been applied to boilers burning oil, gas, and pulverized coal, and to multiple fuel boilers. Boiler sizes ranged from 30,000 lbs./hr. at 200 p.s.i. to 900,000 lbs./hr. at 1800 p.s.i. In every instance, results have been entirely satisfactory.

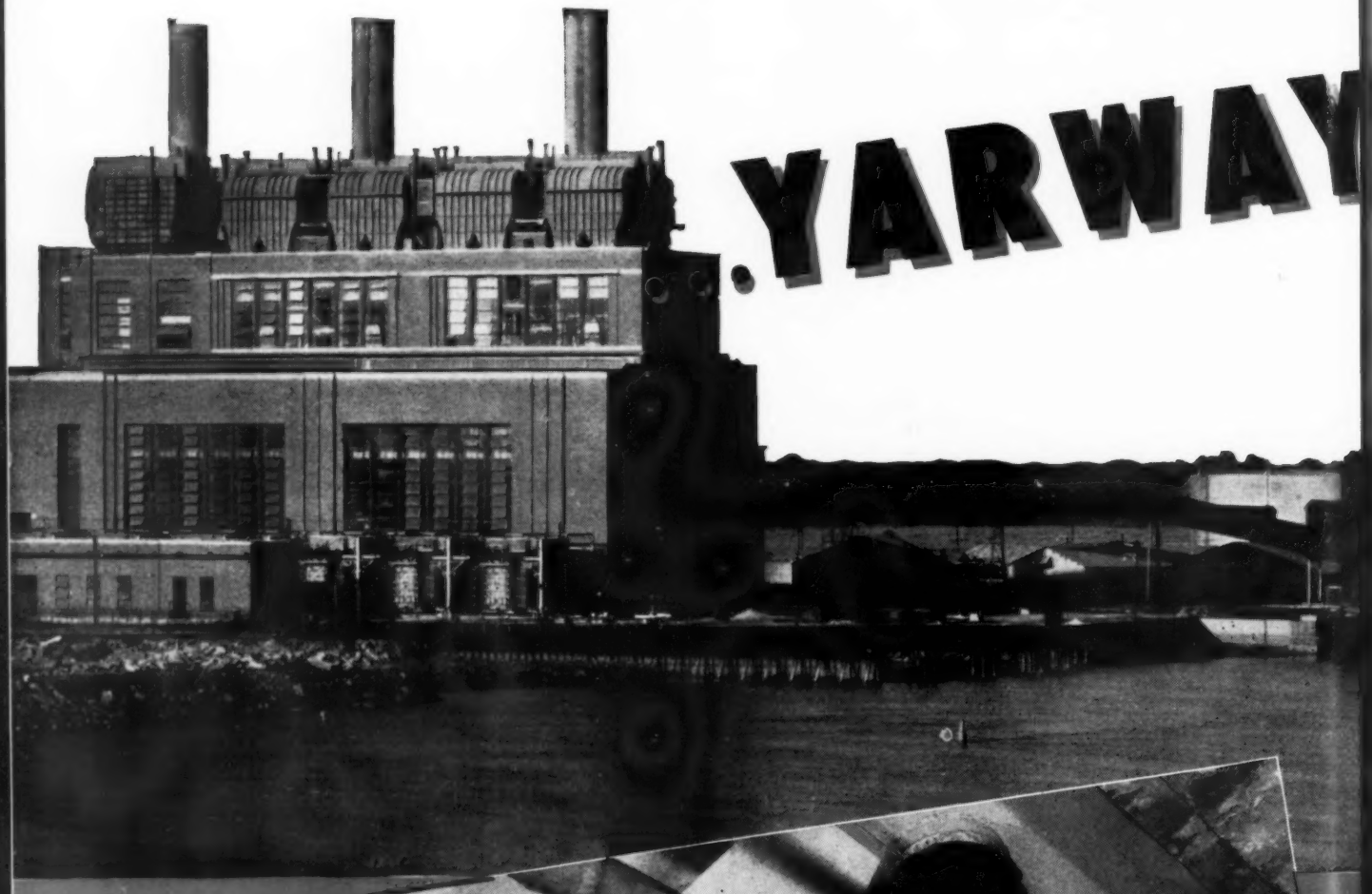
Substantial Fuel Savings. Where the differential master sender can be applied, it gives better control of combustion and substantial savings in fuel. Our engineers will be glad to discuss its possibilities in your plant. Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

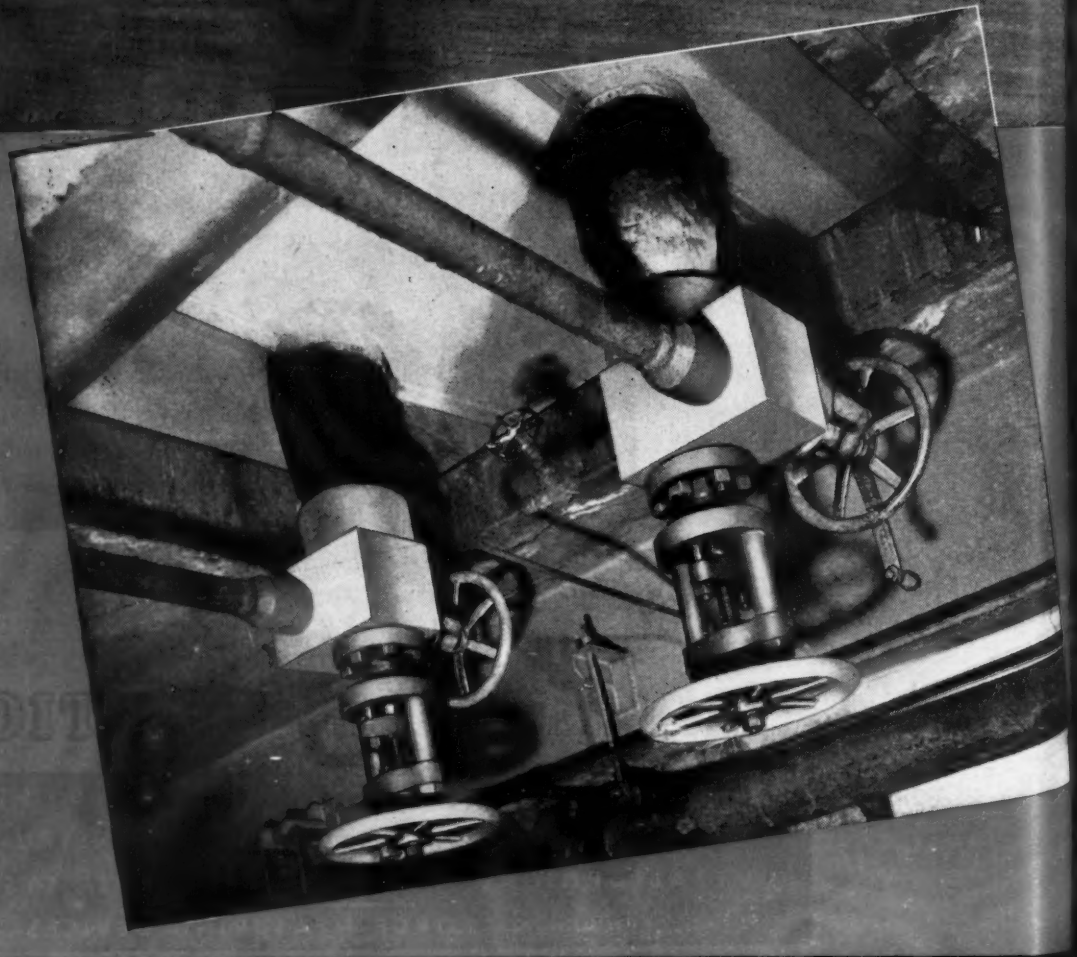
HAGAN CORPORATION

HAGAN
HALL
BUROMIN
CALGON

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

Public Service (N.J.) *Chooses* YARWAY





Burlington, N. J., Station of the Public Service Electric and Gas Company. Four boilers at this plant, and two at Public Service's Marion Station are each equipped with two Yarway Unit Tandems. Steam pressure boiler 1350 psi, turbine 1250 psi. Temperature 950° F. Output, each boiler, 550,000 lbs per hour; high pressure turbines, 125,000 KW each.

YARWAY BLOW-OFF VALVES

UNIT TANDEMS

FOR HIGH PRESSURE BLOW-DOWN SERVICE

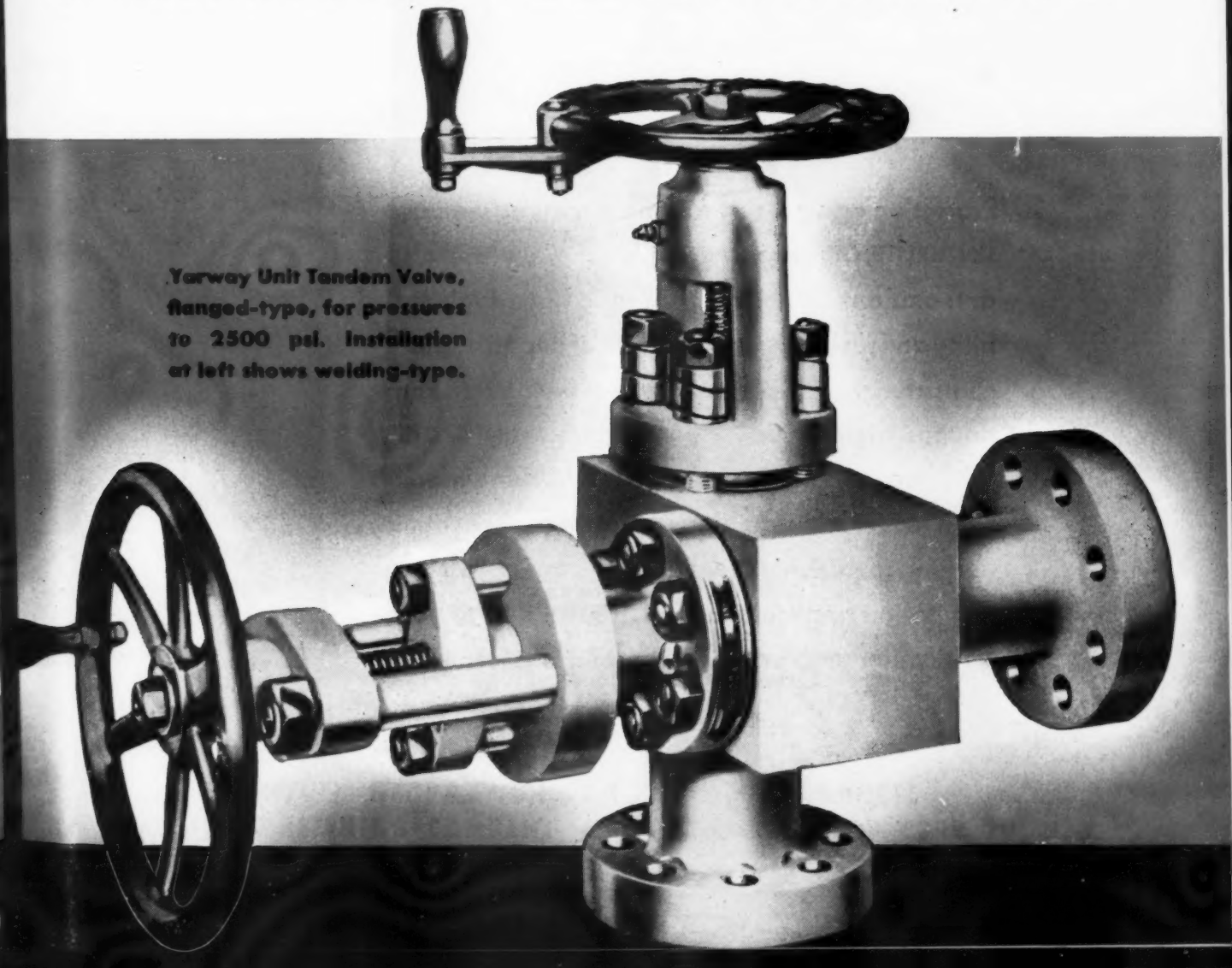
Why has the Public Service Electric and Gas Company of New Jersey, like so many other leading utilities, selected Yarway Unit Tandem Blow-Off Valves for their high pressure boilers? The answer is simple—*proved performance.*

Yarway Unit Tandems have proved themselves unequalled in service throughout all industries on pressures from 400 to 2500 psi. This tandem is a combination of the Yarway Hard-Seat* Valve (next to boiler for blowing) and the famous Yarway Seatless Valve (for sealing)—both contained in a one-piece forged steel body. This rugged construction eliminates the interconnecting flanges, bolts and gaskets required in bolted tandem designs, making a trim, compact unit.

Nearly 40 years of laboratory and field experience concentrated on blow-off valve requirements, makes Yarway a logical source of supply for your next blow-off valves. Write for Catalog B-432 for pressures up to 2500 psi . . . Catalog B-424 for lower pressures.

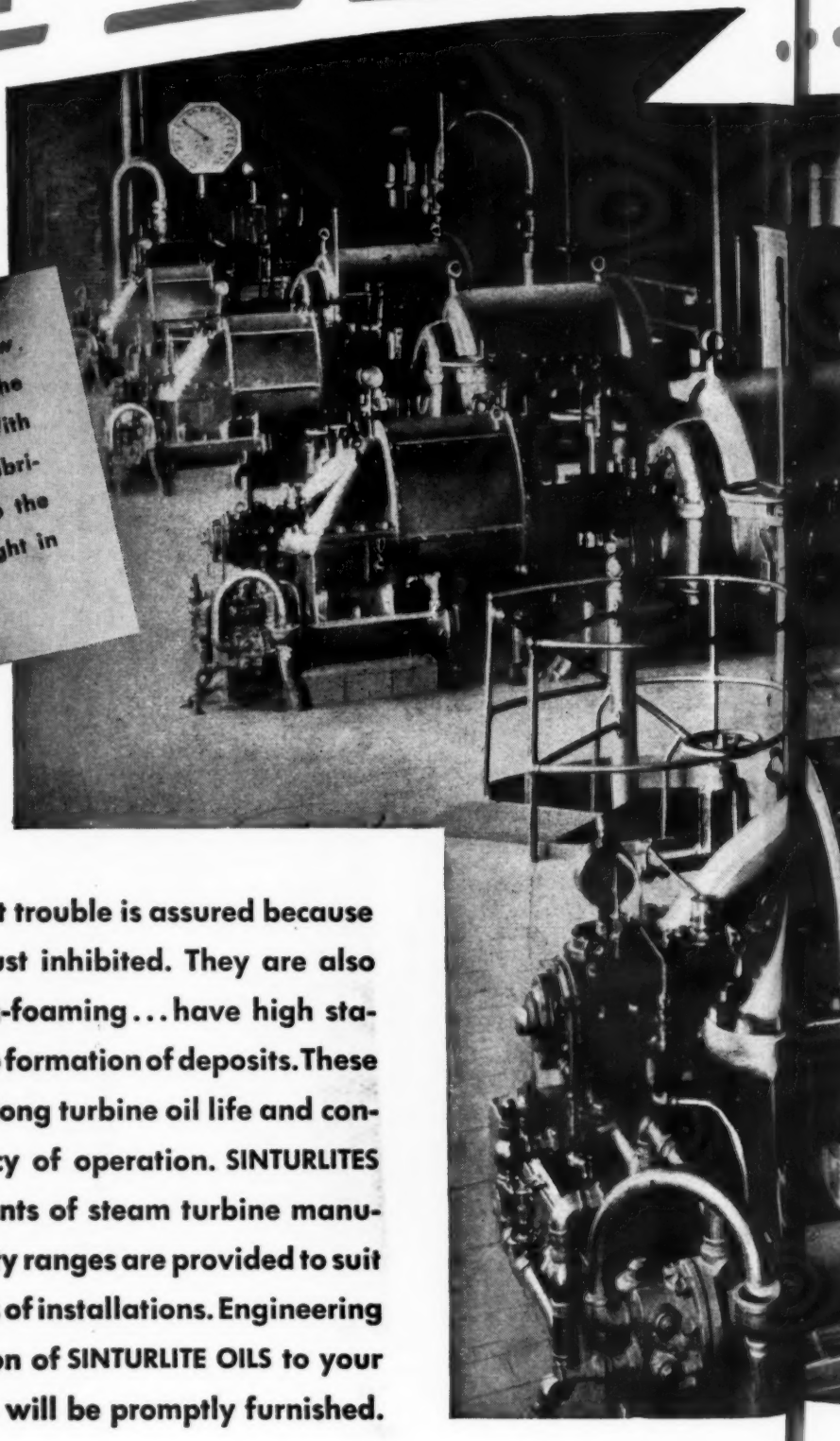
* *Seats furnished either separate or integral.*

YARNALL-WARING COMPANY • 100 Mermaid Avenue, Philadelphia 18, Pa.



Yarway Unit Tandem Valve, flanged-type, for pressures to 2500 psi. Installation at left shows welding-type.

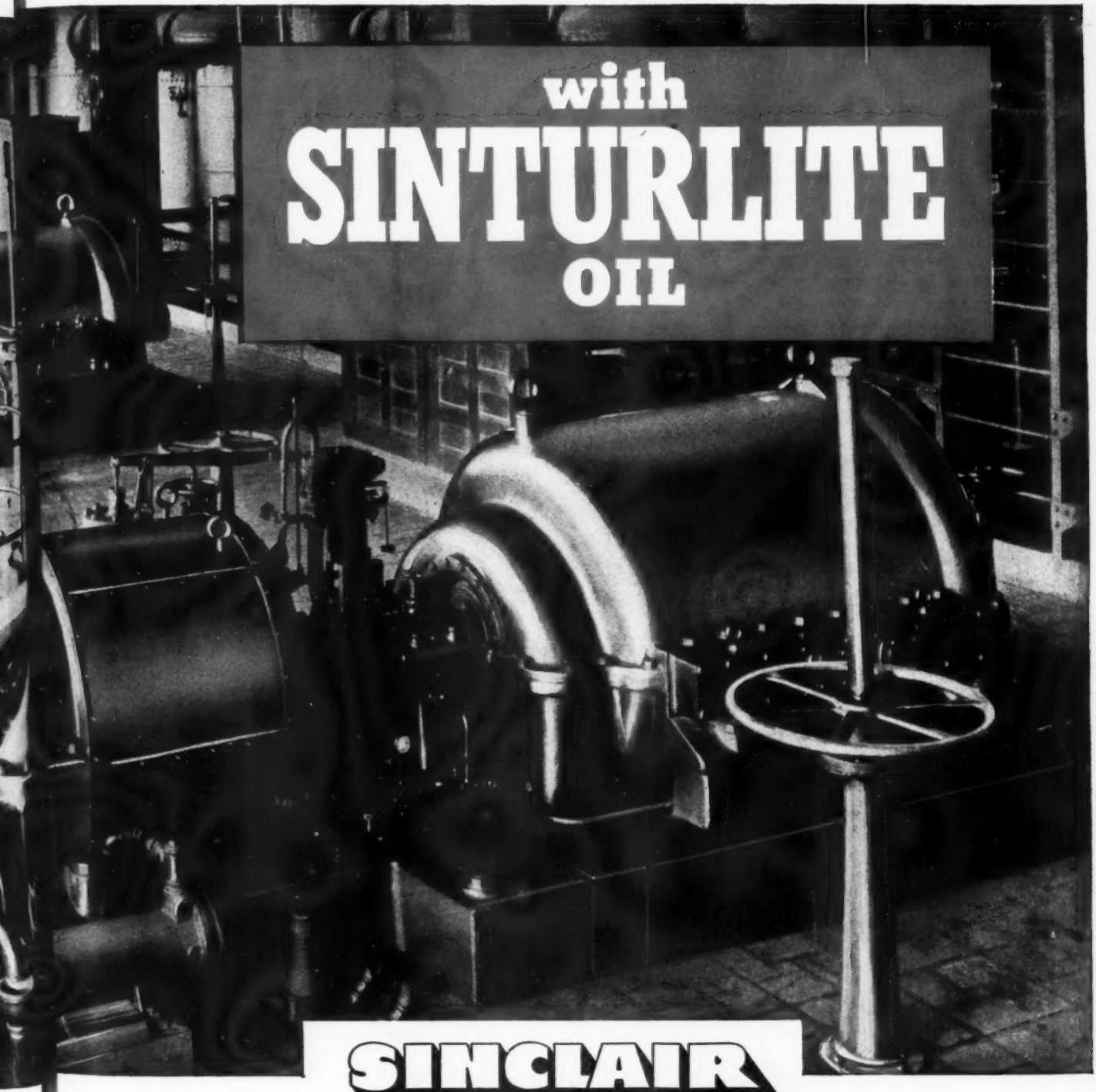
START-UP RIGHT



Rusting is a trouble common to new steam turbine systems unless the right oil is used at start-up. With Sinclair SINTURLITE OIL as the lubricant, the installation is off to the right start-up and it stays right in service operation.

Protection against rust trouble is assured because SINTURLITE OILS are rust inhibited. They are also anti-oxidant and non-foaming... have high stability and resistance to formation of deposits. These characteristics mean long turbine oil life and continuous high efficiency of operation. SINTURLITES fully meet requirements of steam turbine manufacturers. Five viscosity ranges are provided to suit varying requirements of installations. Engineering counsel on application of SINTURLITE OILS to your lubrication problems will be promptly furnished.

..and STAY RIGHT

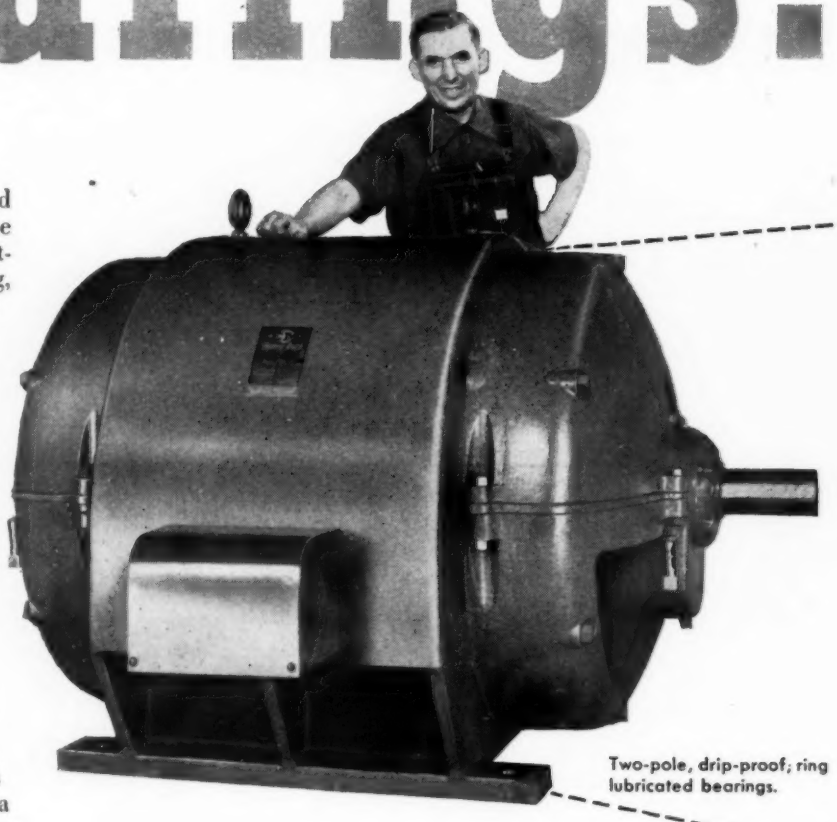


SINCLAIR
INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL
WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVE., NEW YORK 20, N. Y.

THERE'S A DIFFERENCE IN "BIG MOTOR"

Bearings!



Two-pole, drip-proof, ring lubricated bearings.

● You can't take dependability for granted when you buy big motors. Make sure the toughness and reliability you want are built-in! The right kind of bearing engineering, for example, can mean the difference between faithful, profitable performance and costly unnecessary shutdowns.

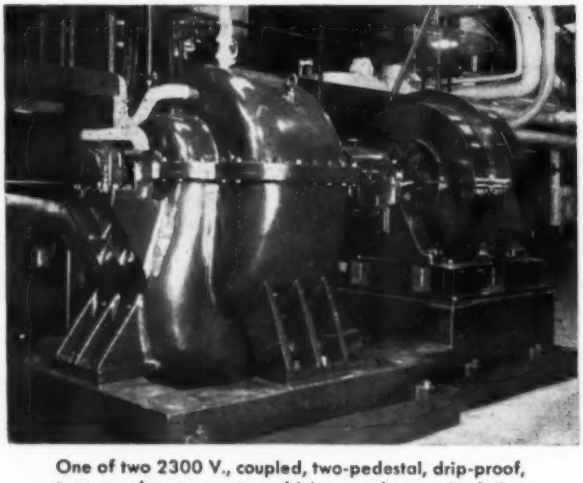
Consider 2-pole induction motors:

Whether you use these motors for boiler feed pumps, oil pipe line pumps or other exacting high-speed drives, you'll place bearing dependability first . . . in such applications, you can really appreciate the wear resistance, the protection and the cool-running qualities engineered into the E-M bearing on the opposite page.

Check and compare these other big-motor features, too: Long-life insulation, indestructible rotor construction, and motor protection. Close scrutiny will show that, in these features, as in bearing design, E-M Heavy-Duty Induction Motors are in a class by themselves. Products of a half century of big motor engineering, these motors may be described in four simple words: *More for your money.*

ELECTRIC MACHINERY MFG. COMPANY
Minneapolis 13, Minnesota

40 YEARS OF SYNCHRONOUS MOTOR KNOW-HOW HELPS BUILD OUTSTANDING INDUCTION MOTORS

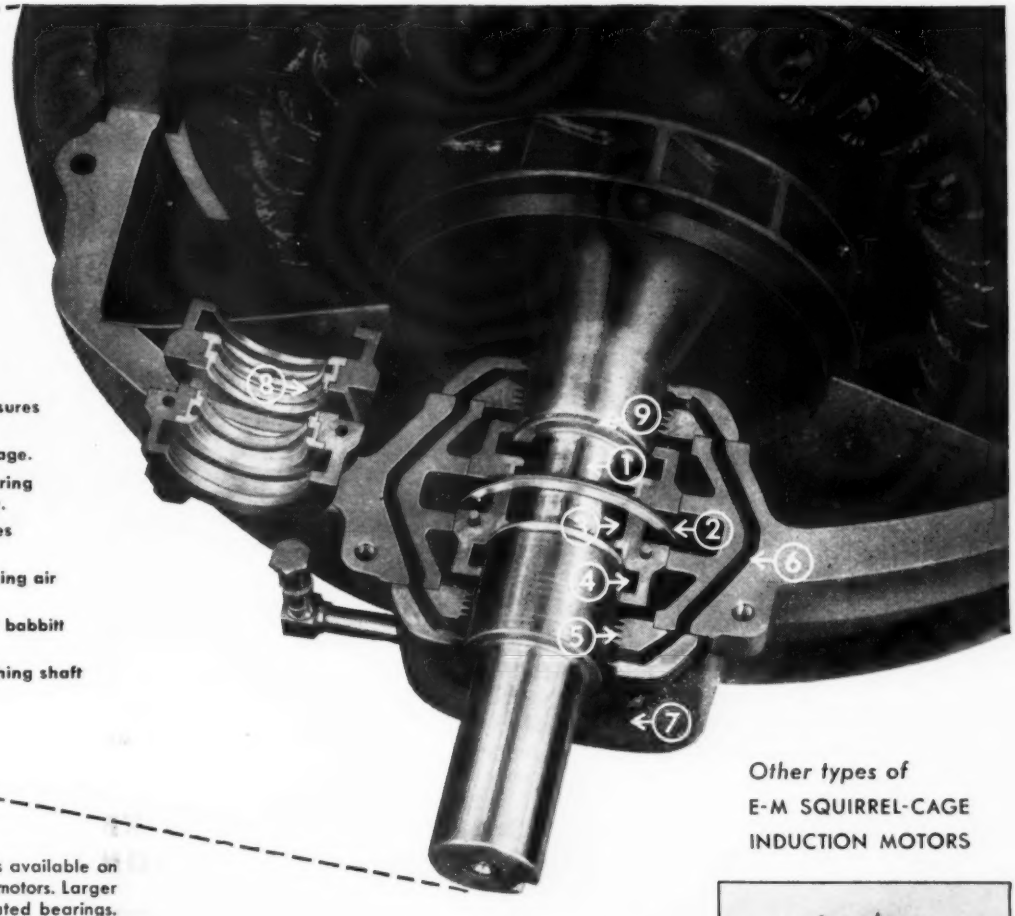


One of two 2300 V., coupled, two-pedestal, drip-proof, type synchronous motors driving condenser circulating pumps in a generating station.

640 HP Synchronous Motor recently installed with a 322 HP Synchronous Motor and E-M magnetic drives to operate forced and induced draft fans for Columbus & Southern Ohio Electric Co.

Look at this bearing construction...in

E-M Heavy duty 2-POLE SQUIRREL CAGE Induction Motors



KOLENE-PROCESS
... electrolytic cleaning and centrifugal-cast bearing lining assures dense, uniform babbitt and tight bonding to the bearing sleeve.

1 Modern one-to-one ratio provides full seating.
2 Central location of oil ring confines turbulence.
3 Special contour of bearing insures uniform film distribution.
4 Drain channels prevent leakage.
5 V-groove seals with no wearing parts maintain full efficiency.
6 Anti-suction groove equalizes pressure.
7 Large oil reservoirs in incoming air stream keep oil cool.
8 Bearing has high tin content babbitt lining.
9 Oil slingers prevent oil reaching shaft proper.

● Bearing construction illustrated is available on 2-pole, 50-60 cycle, 200-700 hp motors. Larger 2-pole ratings use pressure lubricated bearings.

Other types of E-M SQUIRREL-CAGE INDUCTION MOTORS

Two-pole; drip-proof; pressure-lubricated bearings.

Four or more poles; drip-proof; sleeve bearings.

Four or more poles; splash-proof; ball bearings.

THE FEATURES YOU WANT!

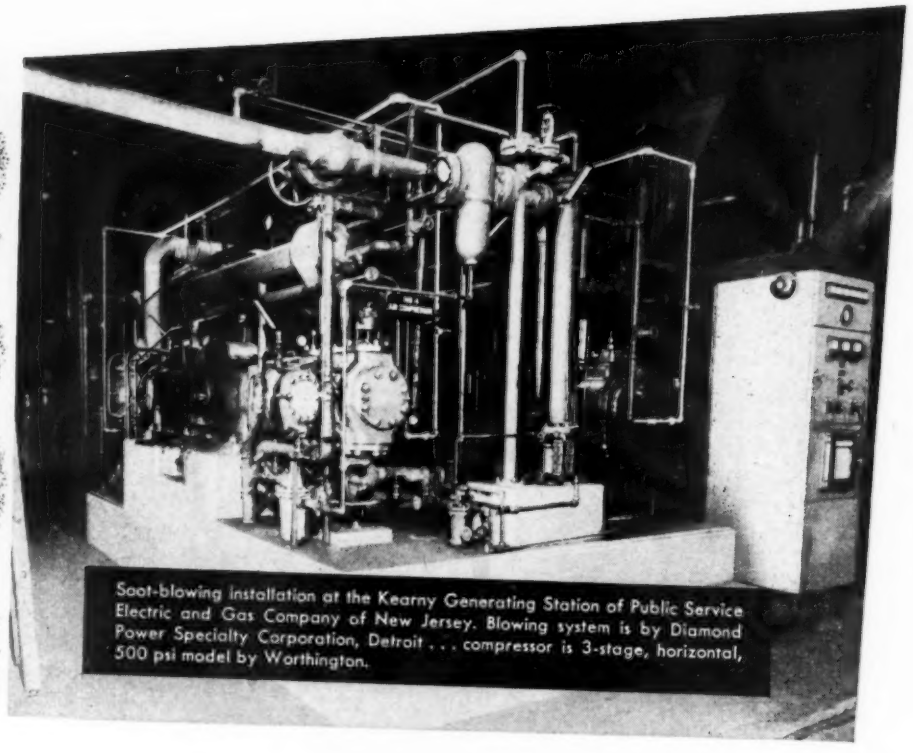
Featuring many up-to-the-minute advances in big motor construction, E-M Squirrel-Cage Heavy Duty Induction motors are available with drip-proof and splash-proof protection. Motors have NEMA Class B starting characteristics. Thus, they have low starting current, making practical in most cases the use of across-the-line starting with its simplicity and low cost. Write for full information, or have your E-M field engineer give you complete details.

E-M

SPECIALISTS IN BIG MOTOR ENGINEERING

1300-TPA-2056

FOR TOP EFFICIENCY IN SOOT BLOWING



Soot-blowing installation at the Kearny Generating Station of Public Service Electric and Gas Company of New Jersey. Blowing system is by Diamond Power Specialty Corporation, Detroit . . . compressor is 3-stage, horizontal, 500 psi model by Worthington.

WORTHINGTON COMPRESSORS MAKE A CLEAN SWEEP

Correct boiler cleaning is yours . . . at a saving in labor . . . when you put an automatic, compressed-air soot-blowing system to work. Compressed air as a cleaning medium offers savings in fuel and savings in feed-water make-up. In addition, the possibility of tube erosion is reduced because condensate is not present in the blowing medium.

SOOT BLOWING AT KEARNY GENERATING STATION

At the Kearny Generating Station of the Public Service Electric and Gas Company, N. J., boiler cleaning became increasingly important, due to a rise in the ash content of the coal. Soot blowing with steam resulted in erosion of the tube surfaces. In addition, the replacement of water removed from the system required chemical treatment and pre-heating.

Compressed-air soot blowing overcame these disadvantages. The Kearny installation operates on an automatic cycle. In the "fog bank" section, four telescopic, long retracting units blow air at about 200 psi over the surface of the tubes, rotating 360 degrees during a projecting and retracting cycle. Short retracting blowers arranged in groups clean the boiler walls and sloping floor.

The booklet, "Worthington Compressors for Soot Blowing" proves *there's more worth in Worthington.* Write for your copy. *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

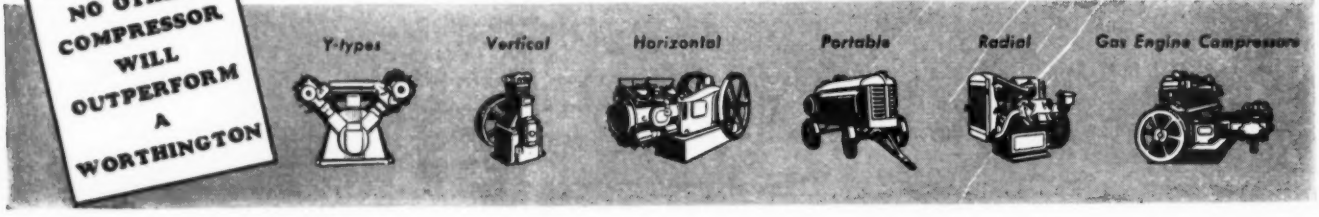
K7.17

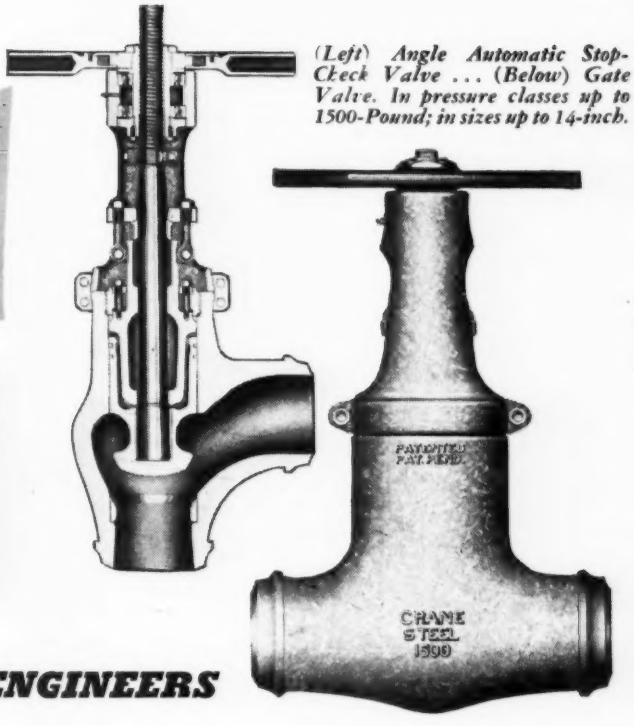
ONLY COMPRESSED-AIR SOOT BLOWING GIVES YOU ALL THESE ADVANTAGES

Saves Fuel . . . Saves feed-water make-up . . . Reduces possibility of tube erosion . . . Permits use of lower-cost, low-temperature piping . . . No piping insulation required . . . Reduces soot blower maintenance . . . Dryer blowing medium . . . More effective medium for slag removal.

WORTHINGTON

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON





(Left) Angle Automatic Stop-Check Valve ... (Below) Gate Valve. In pressure classes up to 1500-Pound; in sizes up to 14-inch.

approved AND preferred

BY LEADING POWER ENGINEERS

Crane PRESSURE-SEAL BONNET VALVES FOR HIGH PRESSURE/TEMPERATURE SERVICE

... And the wave of acceptance rolls on!

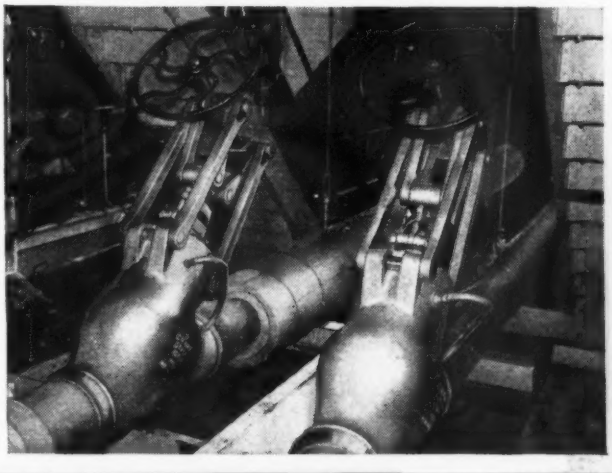
When this revolutionary Crane valve design was first announced—after years of laborious research and testing—we were sure we had a sensational product for power engineers.

Now we're surer than ever! To date, in every part of the country, Crane Pressure-Seal Bonnet Valves have been specified on one or more important projects. And in leading engineering offices, they have been accepted as standard equipment for high pressure/high temperature power plants.

You should know about Crane Pressure-Seal Bonnet Valves if you are planning any new, expanded, or modernized piping. Consult your engineering firm or get in touch with your nearby Crane Branch for complete information.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

12-inch, 1500-Pound Crane Pressure-Seal Stop-Check Valves installed in main steam lines of central station operating at 900 psi, 900 Deg. F.



GATES • GLOBES • ANGLES • STOP-CHECKS

"perfect for power services"

- **Low Pressure Drop and Minimum Turbulence in Globes, Angles, and Checks.**
- **Straight Through Flow in Gates.**
- **No Bonnet Joint Leakage.**
- **No Bonnet Joint Maintenance.**
- **Important Space-and-Weight-Savings over conventional valve design. Gate Valves up to 60% lighter.**
- **New Streamlining Throughout—inside and out.**

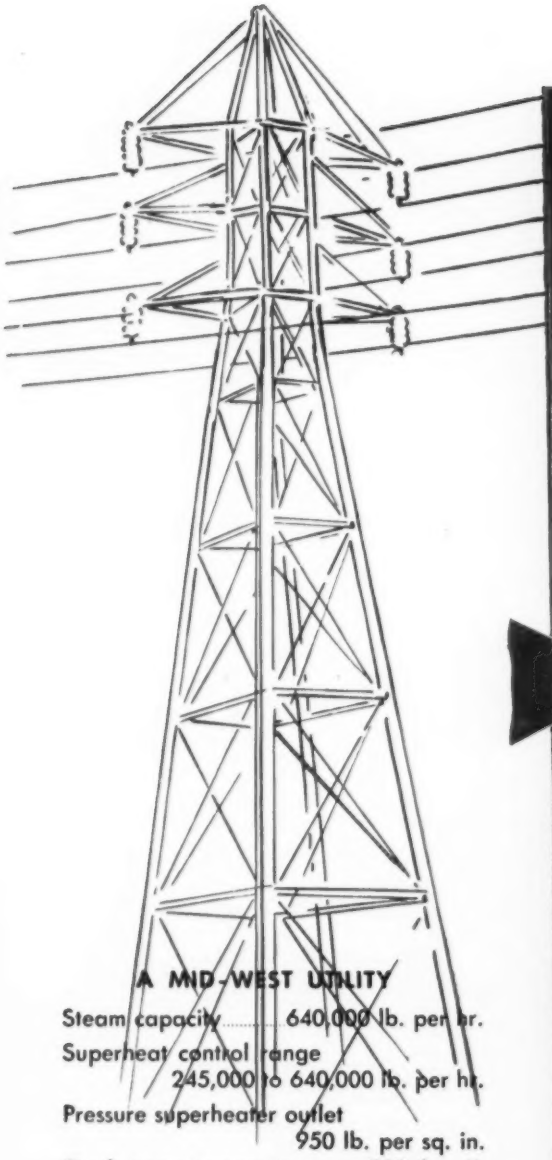
EVERYTHING FROM . . .

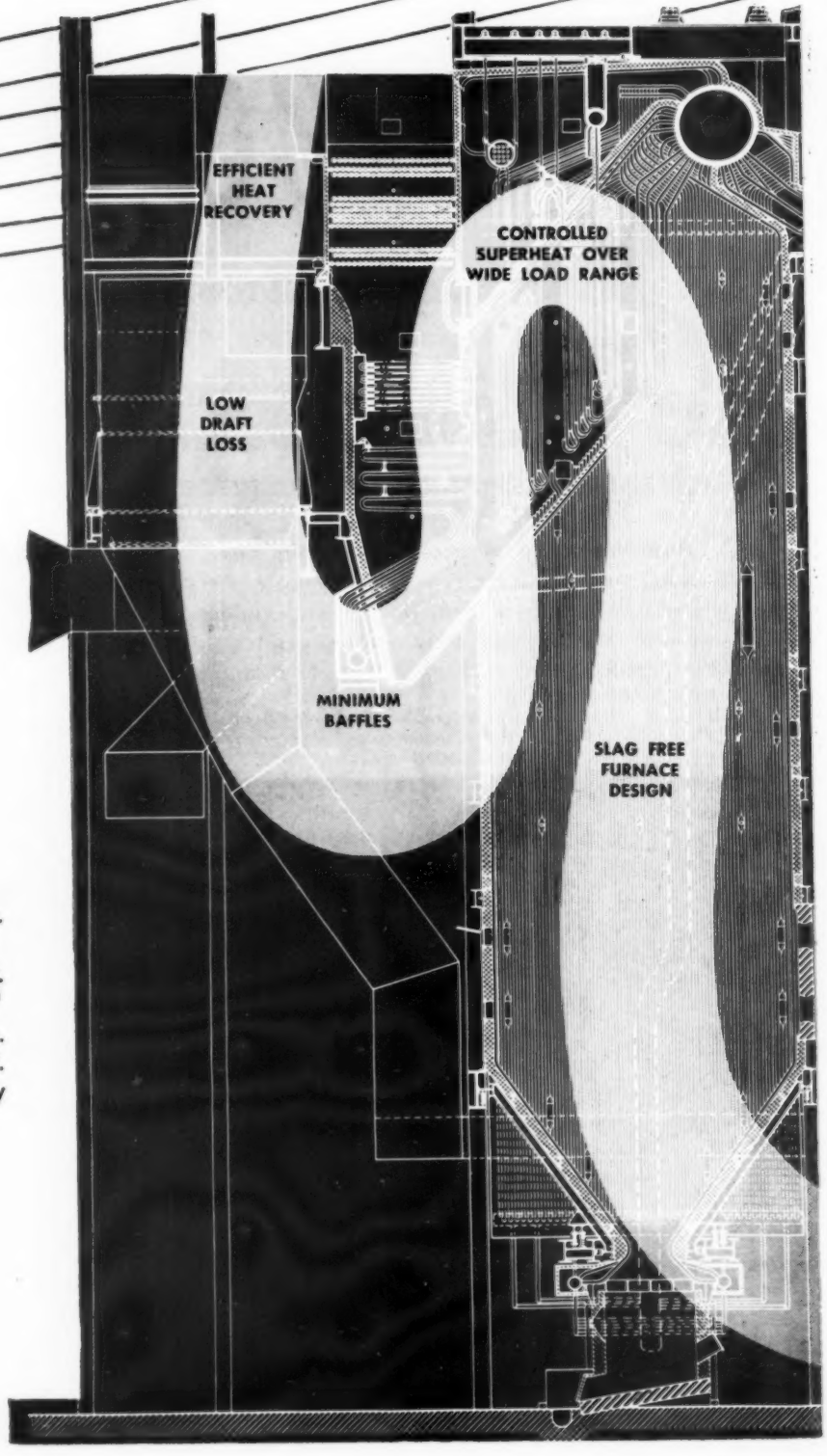
VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

YOUR DOLLARS



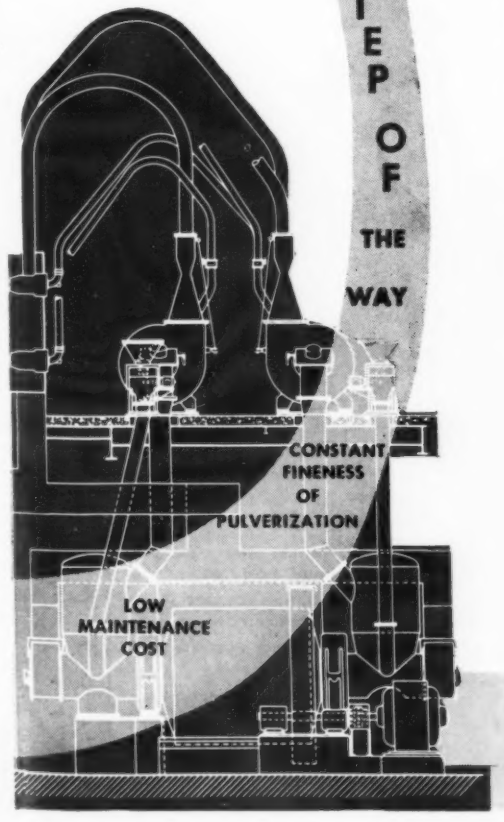


A MID-WEST UTILITY

Steam capacity ..... 640,000 lb. per hr.
Superheat control range
245,000 to 640,000 lb. per hr.
Pressure superheater outlet
950 lb. per sq. in.
Final steam temperature ..... 900 deg. F.
Pulverized coal ..... West Kentucky

MORE POWER AT LOWER COST

PROTECTED EVERY STEP OF THE WAY



The steam generator shown here incorporates an exclusive Foster Wheeler design feature which tends to eliminate baffles. This means—

- *extremely low draft loss;*
- *negligible baffle maintenance.*

Also because of careful design and proportioning of a completely water-cooled furnace –

- *the problem of slagging is eliminated.*

The convection heating surface of the boiler proper consists of waste heat type elements made up of bare and extended surface tubes in series with each element having separate risers to the steam drum.

Foster Wheeler maintains a top place in the field of steam generation by designing and constructing equipment which meets the ever-existing demand for improved efficiency of power generation.

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

TO meet your need for better, more versatile, and more dependable turbine drives, General Electric presents a completely new *standard* turbine—the Type DP.

This turbine incorporates—as *standard* equipment—such outstanding features of large G-E turbines as: hydraulic governing, which gives you a wider speed range and more accurate control; pressure oiling of bearings, which assures you positive, adequate lubrication. In addition, the Type DP embodies many other outstanding features—all designed to give your drives the maximum of performance, and to reduce your maintenance.

Superior design and greater standardization enable us to offer all these special features as standard equipment—at no extra cost. This makes the Type DP, we believe, the greatest value in small turbine history!

WIDE APPLICATION The new Type DP turbine is an ideal drive for pumps, compressors, fans, blowers, and similar equipment. Ratings range from 10 to 1200 hp, speeds from 1000 to 5000 rpm. This turbine is available in three single-stage frame sizes, with a 16-inch, 20-inch, or 25-inch wheel.

GREATER DEPENDABILITY The new oil-relayed governing system does not use fast-wearing elements such as governor thrust bearing, push rods, knife-edges, etc. Rusting problems on standby service are eliminated. More parts are enclosed, and the governing system is totally enclosed in an oil atmosphere. New solid-backed bearings wear better, last longer.

EASIER MAINTENANCE Individual components, such as the oil cooler, oil pump, etc., are readily accessible. The steam strainer and oil strainer can be reached easily for cleaning.

Stocking of spare parts is a simple matter with this new G-E turbine. The great majority of parts are interchangeable on all frame sizes. You can obtain a standard spare parts kit, with parts applicable to all Type DP turbines.

FOR THE FULL STORY For the full story on how the new G-E standard turbine can give you a better power drive, more economically, write today for GEA-4955, a fully illustrated, 20-page descriptive bulletin. Or, call the nearest G-E Apparatus Sales Office.

G-E sales engineers and turbine specialists will be glad to show you how your equipment can benefit from the features of this new drive. And, their wide experience in the application of turbine drive is at your disposal. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

PRESENTS A MECHANICAL-DRIVE

CHECK THESE SPECIAL FEATURES
—STANDARDIZED IN THE NEW G-E TURBINE

Hydraulic governing	Solid-backed bearings
Totally enclosed governor	Rugged rotor design
30% adjustable speed range	Center-line support; fixed shaft height
Accurate speed control	Monel-sprayed journals at packing
Balanced valve design	Nonsparking overspeed governor
Combined trip-throttle valve	Simplified maintenance
Pressure lubrication	Standardized parts
Easily removable oil cooler	Packaged spares
	Attractive, compact unit

NEW STANDARD IN TURBINES

Type DP offers Special Features at no Extra Cost

GENERAL ELECTRIC

252-26

What do you want in a pump shaft?

Strength?
Resistance to corrosion? Hardness? Stiffness?

When you specify *Monel* for pump shafts, you get the combination of qualities needed to combat severe service conditions of wear, stress, vibration, corrosion, and heat. *Monel* insures against frequent, costly replacements; cuts maintenance overhead.

Remember... *Monel* has *all* these features:

- **High resistance to corrosion, corrosion-fatigue, and stress-accelerated corrosion.**
- **Exceptional hardness, which means less wear at bearings and journals.**
- **High resistance to fatigue caused by stress, vibration, and pulsation.**
- **Strength equal to that of steel.**
- **And if you need special properties, there is *"R" Monel* for high-speed production machining; *"K" Monel* that is heat-treatable to tensile strength higher than 150,000 psi; *"KR" Monel* that is both free-machining and heat-treatable.**

For help in solving metal selection problems, send for your INCO NICKEL ALLOYS SELECTOR. This handy slide-rule-type chart tells you at a glance which of the versatile Inco Nickel Alloys will best serve your requirements.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

MONEL
solved these difficult problems—

Case 1. In a large metropolitan power plant, the mild steel shaft of a huge circulating pump failed repeatedly because of corrosion-fatigue. Several other metals were tried without success. Then engineers called for "K" Monel. *The result was the world's largest high Nickel alloy pump shaft*—13'x9" dia.!

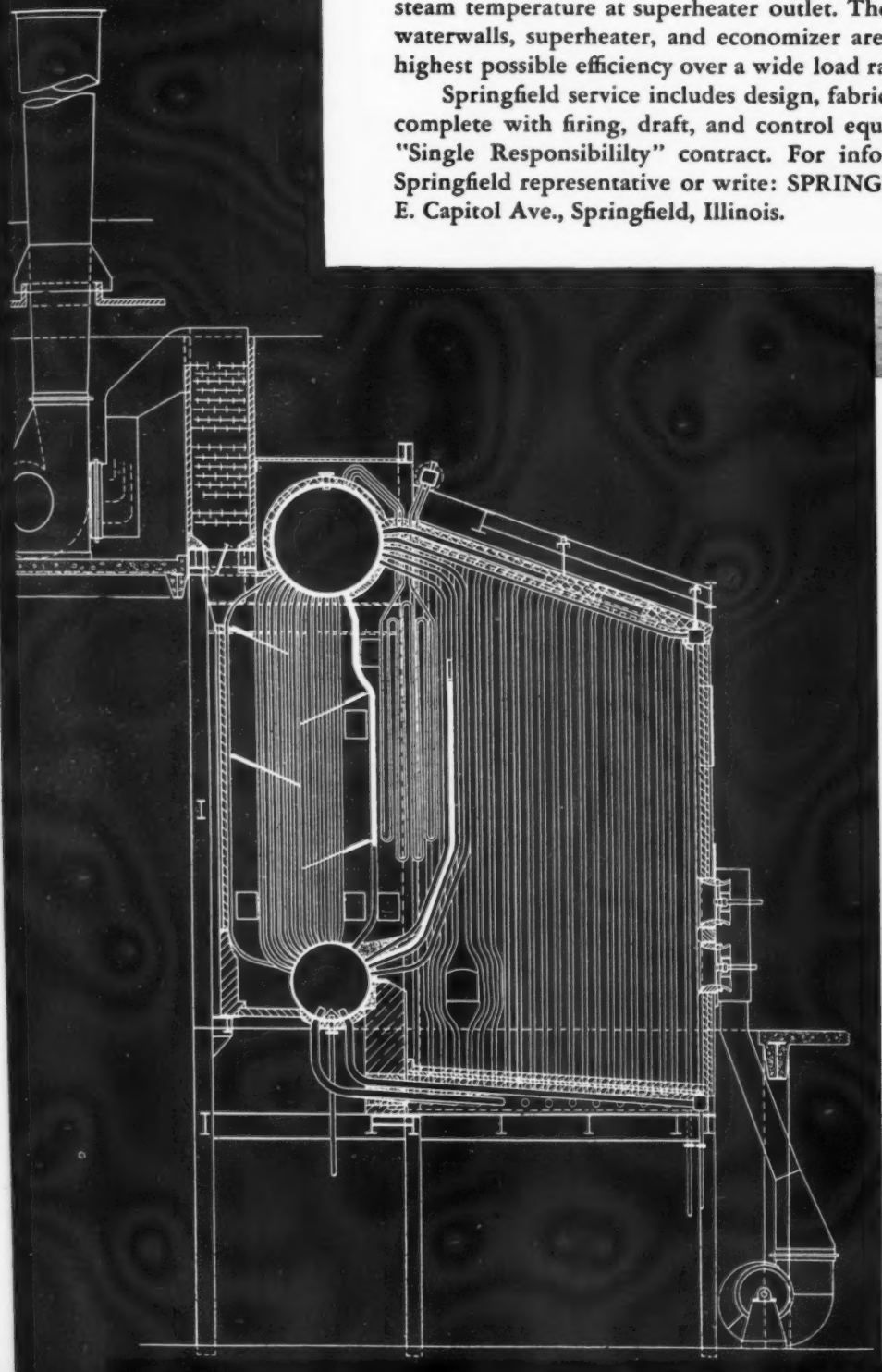
Case 2. A pump manufacturer had difficulty making long, thin shafts for multi-stage high pressure pumps. Stresses set up during machining caused the shafts to deform and fail in service. Heat-treatable *"K" Monel* was tried—and proved to be the solution to this problem, too.

EMBLEM OF SERVICE
NICKEL INCO ALLOYS MONEL* • "K"* MONEL • "S"* MONEL • "R"* MONEL • "KR"* MONEL • INCONEL* • NICKEL • "L"* NICKEL • "Z"* NICKEL
*Reg. U.S. Pat. Off.

COMPLETE STEAM GENERATOR

THIS new Springfield steam generator for municipal service in Clay Center, Kansas, is a typical example of the modern, economical units Springfield is building for power, process, and heating plant service in locations extending from the eastern seaboard to the far west. It is designed to produce 40,000 lbs. of steam per hour at 425 p.s.i. and 750° F. steam temperature at superheater outlet. The heating surfaces in boiler, waterwalls, superheater, and economizer are proportioned to maintain highest possible efficiency over a wide load range with natural gas firing.

Springfield service includes design, fabrication and erection of units complete with firing, draft, and control equipment — all taken under a "Single Responsibililty" contract. For information, see your nearest Springfield representative or write: SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Illinois.



Location: CITY OF CLAY CENTER, Kansas. J. H. Meiers, *Plant Superintendent.*

Consulting Engineers: A. C. KIRKWOOD & ASSOCIATES, Kansas City, Mo.

WORLDWIDE
SALES AND SERVICE

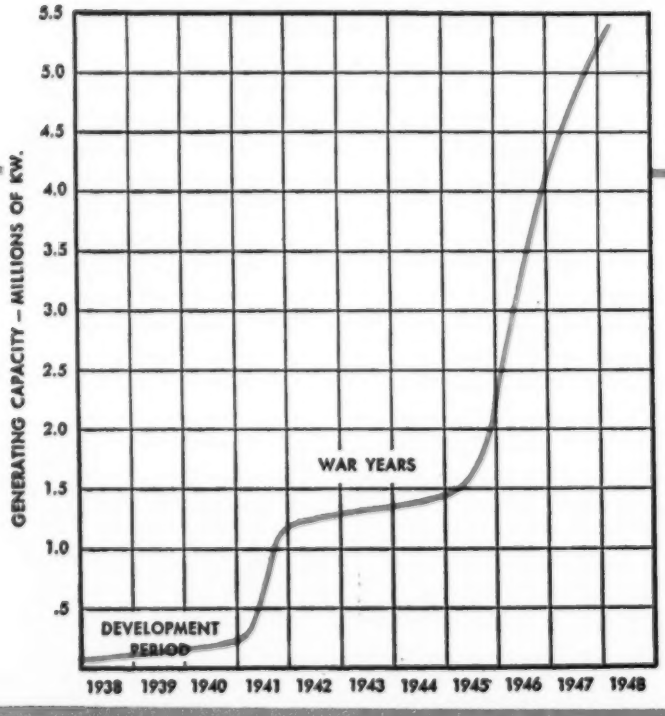
NEW YORK • PHILADELPHIA
CHICAGO • SAN FRANCISCO
WASHINGTON, D. C. • DETROIT
ST. LOUIS • CINCINNATI
SALEM, MASS. • HOUSTON
MEXICO, D. F. • BUENOS AIRES
Export: READING, PA.

SPRINGFIELD BOILERS

SPRINGFIELD BOILER CO.

1953 E. Capitol Ave.
Springfield, Illinois

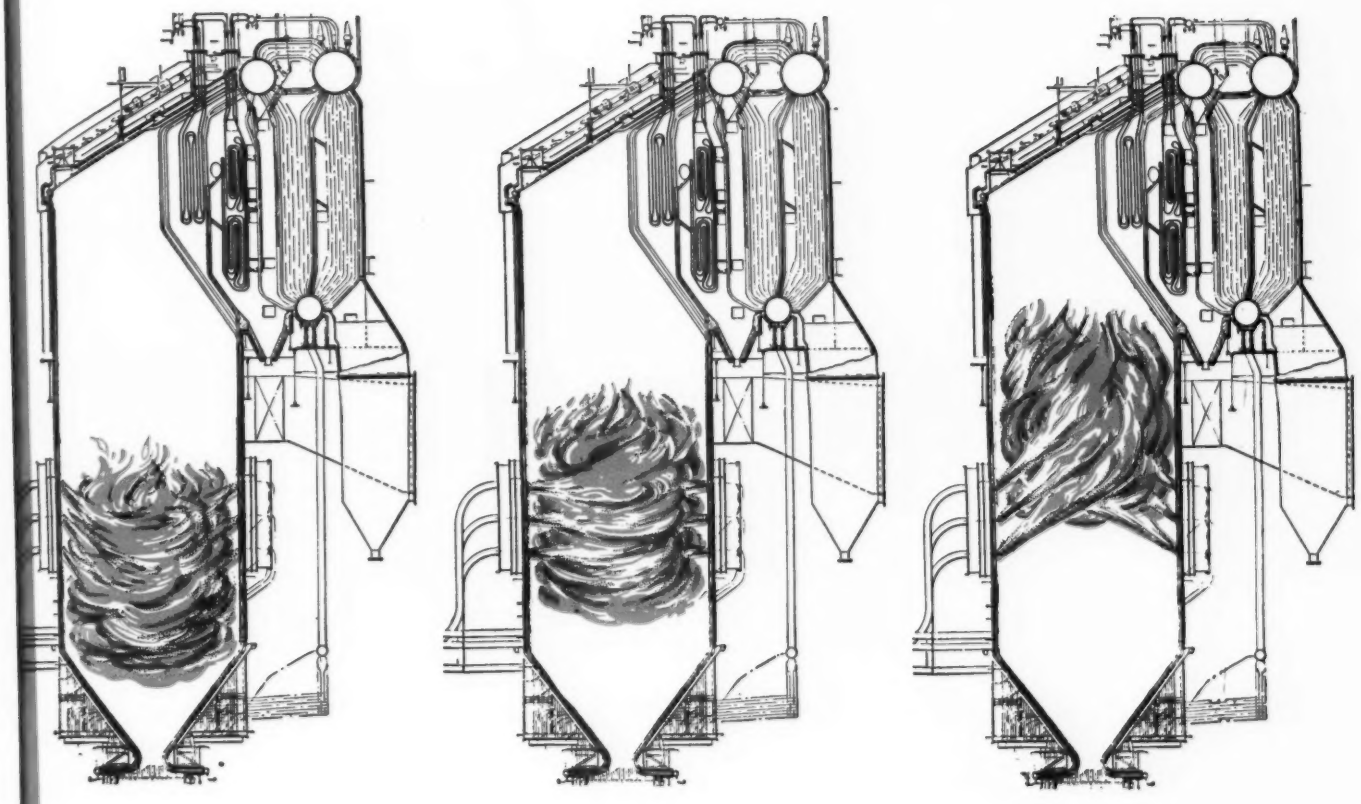
5½ MILLION KW OF ADJUSTABLE-FURNACE BOILERS



Recognition by the Utility Industry of the Adjustable Furnace—Combustion Engineering's contribution to the problem of superheat temperature control for large boilers—is recorded by this chart which shows the cumulative kilowatt capacity equipped or on order. Note that with the exception of the years when war restrictions applied, orders have averaged well over a million kilowatts a year. B-182A

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



The illustrations on this page show how the flame body can be raised or lowered over a considerable distance to make use of more or less furnace heat absorption surface and thereby effect wide range control over the gas temperatures leaving the furnace. Since Vertically Adjustable Burners provide control of furnace heat absorption in the same manner that would be accomplished by the ability to increase or decrease the size of the furnace at will, they provide, in effect, an "adjustable furnace."

ENGINEERING
200 MADISON AVENUE, NEW YORK 16, N. Y.

HERE'S HELP FOR YOUR

LUNKENHEIMER VALVES FOR YOUR FUTURE NEEDS ARE "IN WORK" NOW!

Yes, there are big things ahead. Electric power, for instance . . . added capacity totaling 50% at an expenditure of 5 to 6 billion dollars . . . between now and 1952. And a big part of this job is "planning ahead."

To provide the valves that will be needed in power installations of the future, Lunkenheimer engineers and metallurgists, in collaboration with prominent power engineers, are already at work. Valves to match the new developments in power generation are underway.

As in the improvements achieved over more than a half-century, the cooperation of installation and operating specialists with the Lunkenheimer organization assures valves of greater efficiency and utmost dependability . . . valves that meet the advanced ideas of leading power authorities.

If you plan the expansion of present facilities or the addition of new power plant units, we suggest a conference with the Lunkenheimer representative. His services . . . wide experience and the latest technical information . . . are at your call.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO. U. S. A.

NEW YORK 13 CHICAGO 6 BOSTON 10 PHILADELPHIA 34

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y

LUNKENHEIMER VALVES

1949 PLANS....

BREECH LOCK VALVE . . . Ideally suited for Boiler Feed and Main Steam Line Service. Here is a high pressure-high temperature steel valve construction with a proven maintenance-free service record. Its exclusive and patented design makes possible a strength and structural stability not attainable in any type of construction dependent upon some form of gasket for pressure tightness. Bolting materials, rings, and gaskets that are adversely affected by creep and temperature gradients are eliminated. Pressure tightness is not dependent on narrow metal-to-metal joints of corrodible materials . . . nor are there any gasket bearing surfaces to damage in disassembly and thus prevent making a pressure tight joint on reassembly.

Body-bonnet breech lock joint follows principle used in large guns except that locking is not accomplished by a full thread wedging action. Rather, four series of three coarse lugs are symmetrically formed on the bonnet and in the body. By inserting bonnet in body and turning 45°, the lugs intermesh and lock the two parts together. Breech lugs carry the full internal pressure acting against bonnet. Pressure tightness is maintained by sealing the joint with a small easily removable seal weld.

Leakage is impossible as the combination of lugs and seal weld virtually eliminates a joint. In effect, it is the same as a Full Welded Bonnet construction, with provision for easy disassembly and reassembly in the field.

Fig. 1650

Because of Low Resistance—

BUSS FUSETRONS

Prevent Costly Shutdowns

REDUCE HEATING

In Panelboards and Switches

Three Typical Examples Prove That Fusetrons Operate Cooler

1 In An Office Building

"We manufacture and install panelboards and switches. About 1941 we were called in by the Investment Building, Washington, D. C. to solve a panelboard heating problem. The panelboard, not of our own make, was equipped with pull-out fuse blocks which, when inserted in the panelboard, are completely surrounded by bakelite. There is no chance for any heat to escape. The 400 ampere one-time fuses then in use in the panelboard were heating to the point where they were causing oxidation of the clips. We recommended the installation of 400 ampere Fusetrons in place of the one-time fuses and no heating trouble has since been experienced.

"We had another chance to prove how Fusetrons reduce heating at . . .

2 a Large Plant

"When the HI Ice Cream Company complained that they were having heating trouble in the 600 ampere main switch bought from us. The ordinary one-time fuses were heating to the point where the fibre was charring. By replacing the fuses with solid copper bars we proved that contacts within the switch were good and that the heating trouble was coming from the fuse itself. Then we installed 600 ampere Fusetrons. That was about 3 years ago. Not a Fusetron has been replaced and the panel is operating at normal temperature."

The Shull Electric Products Corp.,
Arlington, Va.
Frank Shull, President

3 Another Office Building

"When the 400 ampere switches in our lighting panelboard were fused with 400 ampere renewable fuses we were troubled by fuse blows occurring at least once a week. Some fuses were loaded with 3 — 200 ampere links and clip clamps were used to insure good contact in the clips, but the fuse blows continued.

"In many instances, the fibre tubes of the fuses were completely destroyed by the heat.

"Our former Chief Electrician in April, 1945 installed 400 ampere Fusetrons in these switches. To date, February, 1948, not one Fusetron in these switches has been replaced, and the heating has been entirely eliminated."

Henry Williamson
Chief Electrician

BUSS

Fusetrons' Cooler Operation Reduces Needless Blows—Keeps Circuits Operating

Switches and panelboards stay cooler with Fusetrons, because Fusetrons cut down heat at its source. The amount of heat produced is in proportion to the amount of resistance. Since the resistance of Fusetrons is very much less than that of ordinary fuses, Fusetrons operate at lower, more efficient temperatures.

This cooler operation eliminates needless blows and useless shutdowns that are the result of heating in fuses. Cooler operation also lengthens the life of switches and panelboards.

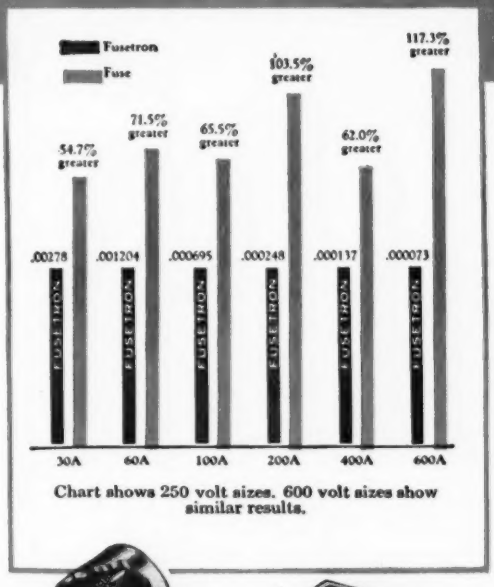
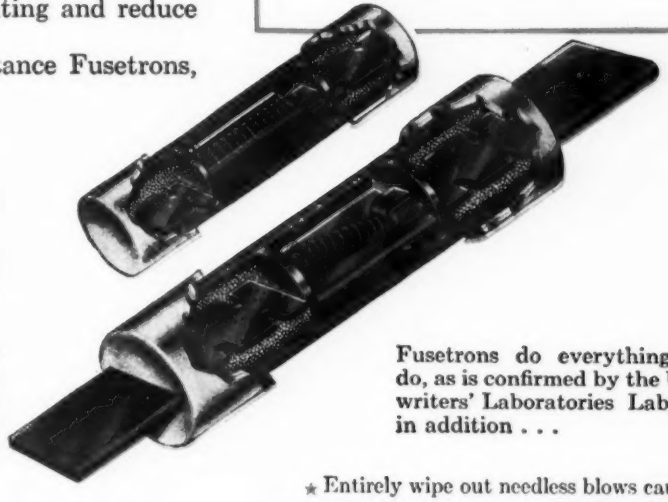


Chart shows 250 volt sizes. 600 volt sizes show similar results.

By Actual Test, Even The Lowest Resistance Fuse Has 55% to 140% Greater Resistance Than a Fusetron

That's why Fusetrons reduce heating, assure more efficient operation, keep circuits operating and reduce costly shutdowns.

It will pay you to install low resistance Fusetrons, and cut down heating at its source.



Fusetrons do everything fuses do, as is confirmed by the Underwriters' Laboratories Label, and in addition . . .

★ Entirely wipe out needless blows caused by motor starting currents or other harmless overloads. ★ Give Thermal Protection to Panelboards and Switches. ★ Lesser resistance means cooler operation and prevents needless blows caused by heating in panels and switches. ★ Permit use of larger motor or adding more motors on circuit WITHOUT installing larger switch or panel. ★ On new installations, PROPER size switches and panels can be used instead of OVERSIZE. ★ Protect small motors against burnout simply and inexpensively. ★ Give DOUBLE protection to large motors. ★ Provide simplest way to stop burnouts from single phasing. ★ Protect coils, transformers and solenoids against burnout.

What Is The Fusetron?

The Fusetron is Bussmann's dual element fuse.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriters' Laboratory approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses, Fusetrons fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere in both 250 and 600 volt types. Also in Plug types for 125 volt circuits.

Their cost is surprisingly low.

Get All The Facts
Get Better Protection *. . . Send The Coupon Now*

One needless shutdown — one destroyed switch or panel — one burned out motor may cost you far more than replacing every fuse with a FUSETRON.

Don't risk such losses — protect yourself by changing over your entire electrical system to FUSETRONS.

Fusetrons

Sold Through Wholesalers

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about BUSS Fusetrons.

*Name*_____

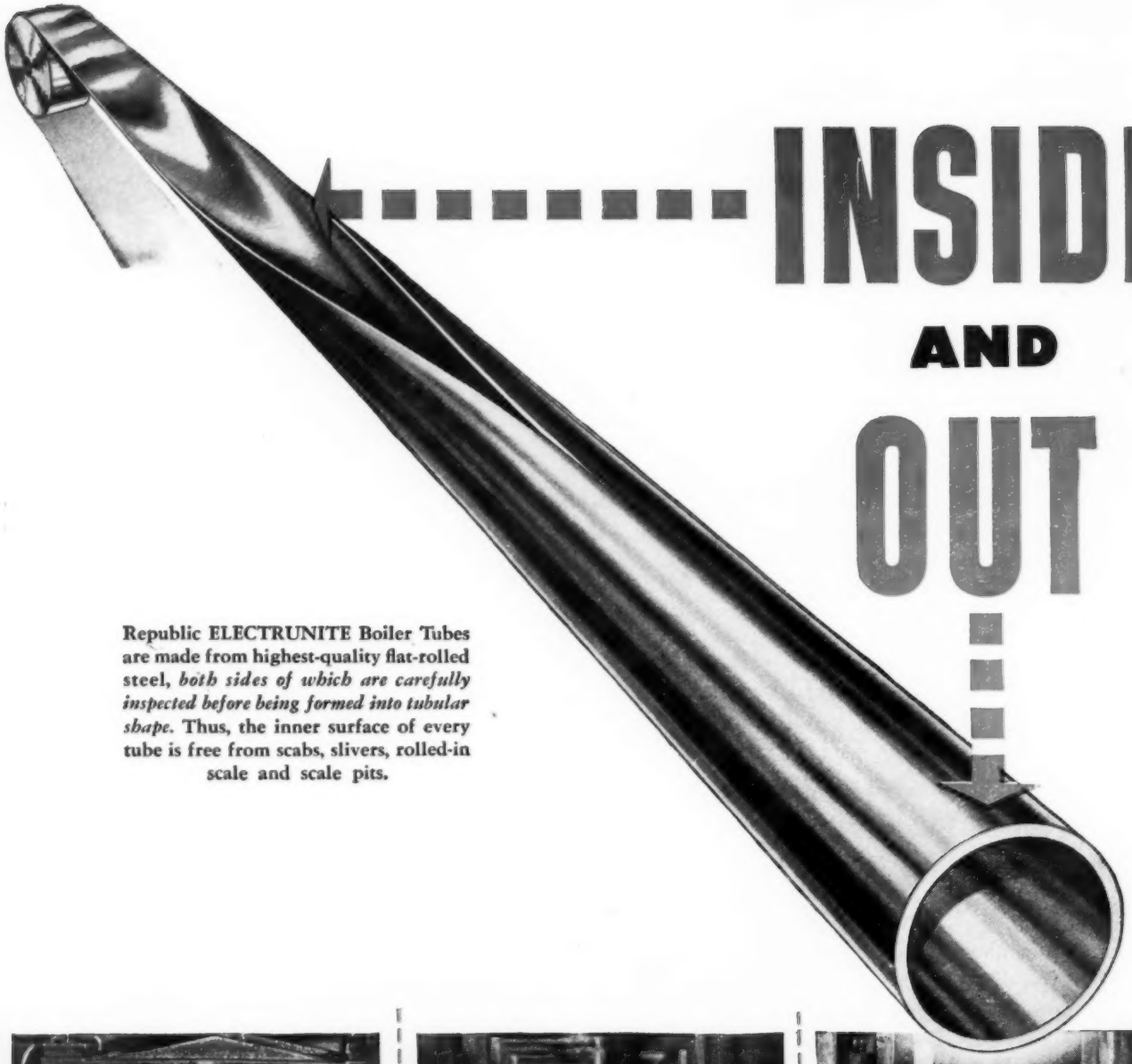
*Title*_____

*Company*_____

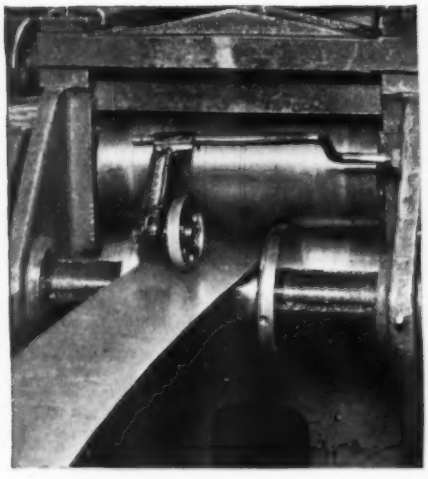
*Address*_____

*City*_____ *State*_____ 548

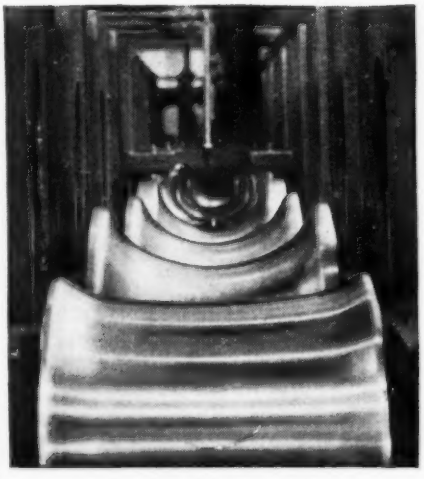
INSIDE AND OUT



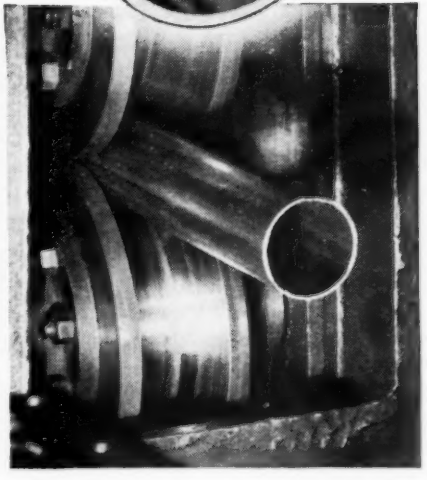
Republic ELECTRUNITE Boiler Tubes are made from highest-quality flat-rolled steel, *both sides of which are carefully inspected before being formed into tubular shape.* Thus, the inner surface of every tube is free from scabs, slivers, rolled-in scale and scale pits.



In the ELECTRUNITE Process, clean flat-rolled steel—*always of uniform thickness*—enters the first in a series of cold-forming rolls . . .



. . . in which increased curvature in each stand of rolls gradually forms the flat steel into uniformly round tubular shape . . .



. . . after which it is welded by Republic's improved electric resistance welding process, and emerges in the form of uniformly sound, strong tubing.

CAREFUL VISUAL INSPECTION ASSURES

Smooth, clean surfaces

IN ELECTRUNITE BOILER TUBES

There's a BIG difference between modern Republic ELECTRUNITE Boiler Tubes and boiler tubes made by other methods.

ELECTRUNITE Boiler Tubes are made of highest quality flat-rolled steel, cold formed into shape and electrically welded into strong, sound tubing. *Thorough visual inspection* of the flat surface which becomes the inside wall of each tube provides positive assurance that there are no hidden defects or trouble-inviting weak spots in the wall. Every ELECTRUNITE Tube is smooth and clean, *inside and out*—uniformly strong and sound throughout its entire length.

Visual inspection is but one of the many rigid tests and inspection procedures included in this modern manufacturing process—resulting in advantages which will save you time, trouble and money when you use ELECTRUNITE—the *original* electric resistance welded boiler tube. For complete information—including a list of sizes, gauges and analyses—write today to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic REPUBLIC STEEL

ELECTRUNITE

Reg. U. S. Pat. Off.

BOILER, CONDENSER AND HEAT EXCHANGER TUBES

TYPICAL REPUBLIC AUTOMATIC

SPREADER STOKERS

ALLIS-CHALMERS MFG. CO.
Springfield, Ill.
2 boilers: 68,000 lb./hr. each: 160 lb.

ALLIED CHEMICAL & DYE CO.
Chicago, Illinois
1 boiler: 45,000 lb./hr.: 125 lb.

BUICK AVIATION PLANT
Melrose Park, Illinois
1 boiler: 90,000 lb./hr.: 175 lb.

CHICAGO & NORTHWESTERN R. R. CO.
Green Bay, Wisconsin
2 boilers: 25,000 lb./hr. each: 125 lb.

DAIN MFG. CO.
Ottumwa, Iowa
2 boilers: 518 hp. each: 175 lb.

HUBINGER CO.
Keokuk, Iowa
1 boiler: 150,000 lb./hr.: 500 hp.

CLINTON ENGINEERING WORKS
Oliver Springs, Tenn.
3 boilers: 40,000 lb./hr. each: 300 lb.

CLINTON ENGINEERING WORKS
Clinton, Tenn.
3 boilers: 50,000 lb./hr.: 175 lb.

NORTHWESTERN YEAST CO.
Chicago, Illinois
1 boiler: 338 hp.: 140 lb.
2 boilers: 253 hp.: 140 lb.

MARSHALL CANNING CO.
Marshalltown, Iowa
1 boiler: 40,000 lb./hr.: 160 lb.

KRAFT FOODS
Hutchinson, Minn.
2 boilers: 316 hp. each: 150 lb.

KRAFT FOODS
Albany, Minn.
2 boilers: 338 hp. each: 160 lb.

PYRAMID COAL CORP.
Pinchnieyville, Illinois
3 boilers: 40,000 lb./hr. each: 210 lb.

WALWORTH CO.
Kewanee, Illinois
1 boiler: 60,000 lb./hr.: 200 l

SCHENLEY DISTI
Lawrenceb
2 boil

GINGS CORP.
Harbor, Indiana
oiler: 30,000 lb./hr.: 150 lb.

U. S. NAVAL TRAINING STATION
Farragut, Idaho
2 boilers: 412 hp. each: 100 lb.
2 boilers: 350 hp. each: 100 lb.
4 boilers: 250 hp. each: 100 lb.
2 boilers: 500 hp. each: 100 lb.

CHAIN GRATE STOKER

ADAMS & WESTLAKE CO.
Elcart, Indiana
2 boilers: 500 hp. each: 125 lb.

BETHLEHEM STEEL CO.
Bethlehem, Pa.
4 boilers: 600 hp. each: 160 lb.

THE BERYLLIUM CORP. OF PA.
Temple, Pa.
2 boilers: 22,500 lb./hr. each: 145 lb.

BLESSING HOSPITAL
Quincy, Illinois
1 boiler: 150 hp.: 100 lb.

CHICAGO, NORTHWESTERN R. R.
Chicago, Illinois
3 boilers: 45,000 lb./hr. each: 160 lb.

CLINTON PRODUCTS CO.
Clinton, Iowa
2 boilers: 25,000 lb./hr. each: 200 lb.

CORN PRODUCTS REFINING CO.
Pekin, Illinois
1 boiler: 175,000 lb./hr.: 400 lb.

HOUDAILLE HERSHEY CORP.
Decatur, Illinois
4 boilers: 25,000 lb./hr. each: 125 lb.

HOOSIER LAMP & STAMPING CORP.
Evansville, Indiana
1 boiler: 400 hp.: 150 lb.

MURRAY CORPORATION OF AMERICA
Scranton, Pa.
2 boilers: 35,000 lb./hr. each: 125 lb.

KREY PACKING
St. Louis, Mo.
1 boiler: 400 hp.: 350 lb.

ROCKFORD MITTEN & HOSIERY CO.
Rockford, Illinois
2 boilers: 400 hp. each: 110 lb.

U. S. RUBBER CO.
Passaic, New Jers
2 boilers: 40,0
2 boil

lb./hr. each: 125 lb.
32,000 lb./hr. each: 125 lb.

U. S. MARINE HOSPITAL
Klamaith Falls, Oregon
4 boilers: 500 hp. each: 100 lb.

REPUBLIC RUBBER DIVISION
Youngstown, Ohio
1 boiler: 65,000 lb./hr.: 450 lb.

ALUMINUM FORGINGS, INC.
Erie, Pa.
3 boilers: 50,000 lb./hr. each: 145 lb.

GRIESEDIECK WESTERN BREWERY
Belleville, Illinois
1 boiler: 600 hp.: 125 lb.

UNDERFEED STOKERS

EDWARD G. BUDD MFG. CO.
Philadelphia, Pa.
3 boilers: 100,000 lb./hr. each: 150 lb.

CHEVROLET MOTORS
Bay City, Michigan
1 boiler: 600 hp.: 150 lb.

INDEPENDENT PNEUMATIC TOOL CO.
Aurora, Illinois
1 boiler: 300 hp.: 300 lb.

THE OLD QUAKER CO.
Lawrenceburg, Indiana
2 boilers: 500 hp. each: 160 lb.

REO MOTORS, INC.
Lansing, Michigan
1 boiler 40,000 lb./hr.: 260 lb.

ST. JOHN'S HICKEY MEMORIAL HOSPITAL
Anderson, Indiana
2 boilers: 150 hp. each: 150 lb.

U. S. FINISHING CO.
Norwich, Conn.
1 boiler: 40,000 lb./hr.: 165 lb.

UPJOHN COMPANY
Kalamazoo, Michigan
1 boiler: 40,000 lb./hr.: 160 lb.

U. S. MARINE AIR STATION
Cherry Point, North Carolina
3 boilers: 55,000 lb./hr. each: 175 lb.

MILITARY VEHICLE & FIN
Detroit, Michigan
3 boilers: 28,0

NG PLANT
lb./hr. each: 150 lb.

MBUS ASF DEPOT
Columbus, Ohio
1 boiler: 26,000 lb./hr.: 90 lb.

MUNICIPAL WATER & LIGHT PLANT
St. Marys, Ohio
2 boilers: 35,000 lb./hr. each: 235 lb.

TIMKEN ROLLER BEARING CO.
Columbus, Ohio
1 boiler: 60,000 lb./hr.: 400 lb.

U. S. MILITARY ACADEMY
West Point, N. Y.
2 boilers: 100,000 lb./hr. each: 160 lb.
1 boiler: 120,000 lb./hr.: 160 lb.

U. S. NAVY YARD
Charleston, S. C.
2 boilers: 20,000 lb./hr. each: 160 lb.

GEO. WIEDEMANN BWG. CO.
Newport, Ky.
1 boiler: 456 hp.: 125 lb.

REPUBLIC
Are Being
FOR ALL SIZES OF BOILERS AND

COMBUSTION CONTROL INSTALLATIONS

PULVERIZED COAL

BELTON MILLS
Belton, South Carolina
1 boiler: 60,000 lb./hr.: 250 lb.

BOECKELER ASSOCIATES
Trenton, Michigan
1 boiler: 528 hp.: 125 lb.

GEORGIA POWER COMPANY
Harryat, Georgia
1 boiler: 600,000 lb./hr.: 975 lb.

HARTFORD CITY PAPER COMPANY
Hartford City, Indiana
1 boiler: 80,000 lb./hr.: 325 lb.

CLINTON ENGINEERING WORKS
Oliver Spriggs, Tenn.
1 boiler: 750,000 lb./hr.: 1375 lb.

U. S. NAVY YARD
Portsmouth, Virginia
1 boiler: 120,000 lb./hr.: 380 lb.

WRIGHT FIELD
Dayton, Ohio
1 boiler: 100,000 lb./hr.: 300 lb.

N. Y., N. H. & HARTFORD R. R. CO.
Cos Cob, Conn.
1 boiler: 150,000 lb./hr.: 325 l

PRATT & WHITNE
East Hartfo
2 boi

Conn.
: 20,000 lb./hr. each: 175 lb.

U. S. MARINE BARRACKS
Quantico, Virginia
1 boiler: 120,000 lb./hr.: 125 lb.

CENTRAL ILLINOIS PUBLIC SERVICE CO.
Hutsonville Station
Hutsonville, Ill.
2 boilers: 150,000 lb./hr. each: 665 lb.

COMMONWEALTH EDISON CO.
Northwest Station
Chicago, Illinois
3 boilers: 425,000 lb./hr. each: 1325 lb.

NORFOLK NAVY YARD
Portsmouth, Va.
3 boilers: 120,000 lb./hr. each: 400 lb.

NORTHERN PAPER MILLS
Green Bay, Wis.
2 boilers: 75,000 lb./hr. each: 650 lb.

WILLIAMSBURG POWER PLANT
Brooklyn, N. Y.
2 boilers: 375,000 lb./hr. each: 875 lb.

OIL FIRED

BAY REFINING CORP.
Bay City, Michigan
1 boiler: 350 hp.: 245 lb.

FITCHBURG GAS & ELEC. LIGHT CO.
Fitchburg, Mass.
2 boilers: 120,000 lb./hr. each: 200 lb.

PHILADELPHIA NAVY YARD
Philadelphia, Pa.
2 boilers: 130,000 lb./hr. each: 175 lb.

U. S. NAVAL HOSPITAL
Oakland, California
5 boilers: 490 hp. each: 125 lb.

U. S. NAVAL MAGAZINE
Port Chicago, California
3 boilers: 210 hp. each: 125 lb.

U. S. NAVAL HOSPITAL
San Leandro, California
3 boilers: 500 hp. each: 135

CITIES SERVICE
Lake Char
4 bo

/hr. each: 250 lb.
,000 lb./hr. each: 250 lb.

GAS FIRED

BEECH AIRCRAFT CORPORATION
Wichita, Kansas
2 boilers: 180 hp. each: 100 lb.

GULF POWER COMPANY
Pensacola, Florida
1 boiler: 230,000 lb./hr.: 875 lb.

GENERAL TIRE & RUBBER CO.
Waco, Texas
3 boilers: 16,000 lb./hr. each: 190 lb.

LONG-BELL LUMBER CO.
De Ridder, La.
3 boilers: 250 hp. each: 165 lb.

MATHIESON ALKALI WORKS, INC.
Lake Charles, La.
1 boiler: 420,000 lb./hr.: 925 lb.

MISSISSIPPI POWER CO.
Hattiesburg, Mississippi
1 boiler: 230,000 lb./hr.: 875 lb.

TIDEWATER ASSOCIATED OIL CO.
Avon, California
2 boilers: 100,000 lb./hr. each: 250 lb.

ABERCRAMBIE-HARRISON OIL CO.
Sweeney, Texas
4 boilers: 100,000 lb./hr. each: 250 lb.

COMBINATION FIRING

CROWN CENTRAL PETROLEUM CORP.
Houston, Texas
3 boilers: 75,000 lb./hr. each: 450 lb.
Gas & Oil

KOPPERS UNITED CO.
Kobuta, Pa.
1 boiler: 150 hp.: 165 lb.
Coal & Oil

STANDARD OIL CO. OF NEW JERSEY
Canton, New Jersey
1 boiler: 150,000 lb./hr.: 605 lb.
Gas & Oil

CITY PUBLIC SERVIC
San Antonio, T
1 boiler

: 605 lb.

PUBLIC SERVICE BOARD
San Antonio, Texas
1 boiler: 275,000 lb./hr.: 200 lb.
1 boiler: 200,000 lb./hr.: 200 lb.
Gas & Oil

S & W FINE FOODS, INC.
Redwood City, California
1 boiler: 335 hp.: 105 lb.
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UTAH OIL REFINING CO.
Salt Lake City, Utah
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U. S. NAVAL OPERATING BASE
Norfolk, Va.
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Pulverized Coal & Oil

PENICK & FORD, LTD. INC.
Cedar Rapids, Iowa
1 boiler: 150,000 lb./hr.: 500 lb.
Gas and pulverized coal

STANDARD OIL CO. OF CALIF.
Richmond, Calif.
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Gas, oil, acid sludge

LOUISIANA STEAM GEN. CORP.
(Gulf States Utilities)
Baton Rouge, La.
2 boilers: 500,000 lb./hr. each: 670 lb.
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THE TEXAS CO.
Port Arthur, Texas
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CONTROLS
Specified
ALL TYPES OF FUEL FIRING

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Super-7 V-belts	5 types . . . sizes to suit every power transmission job	
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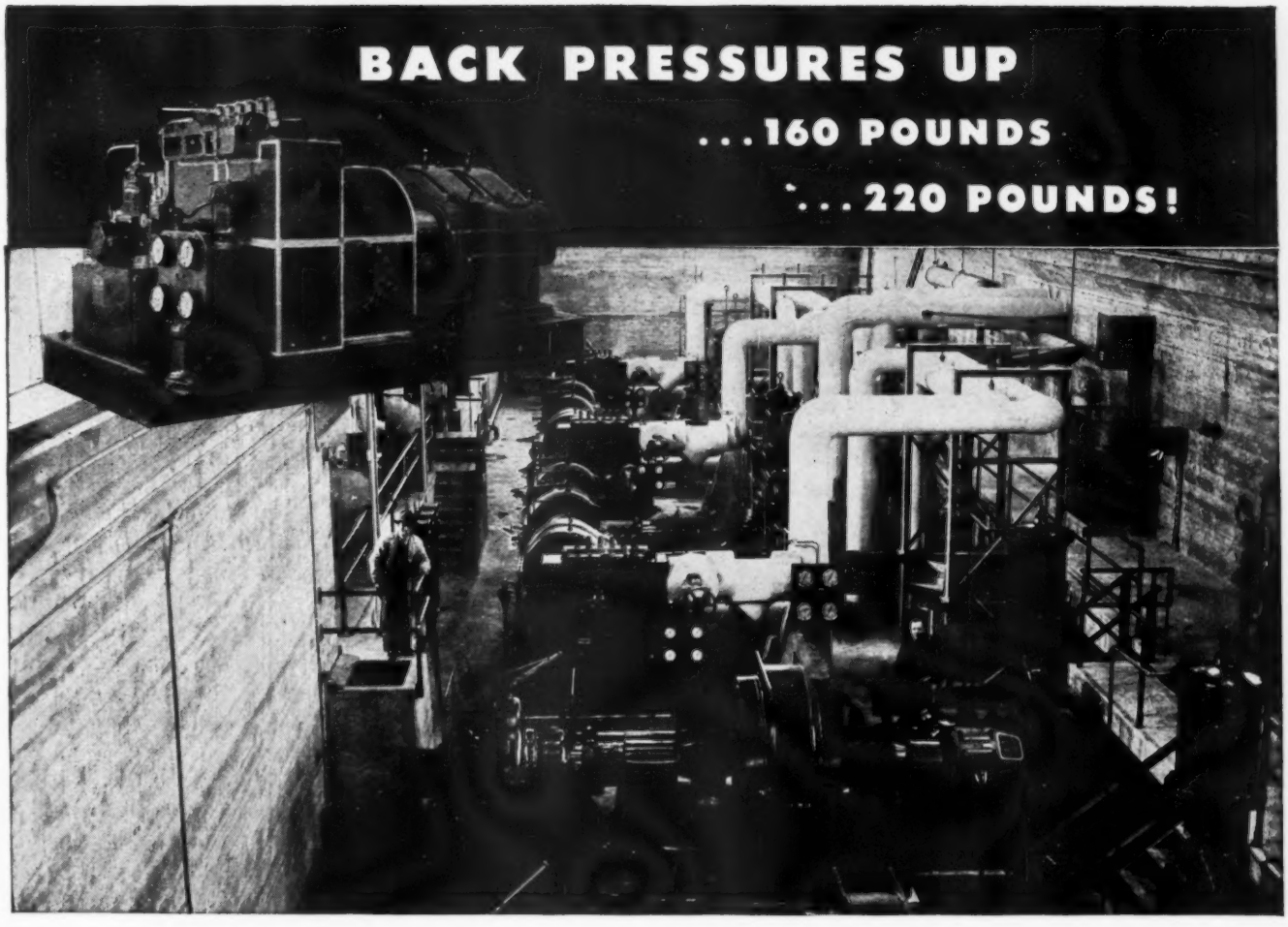
Vari-Pitch Sheaves	Exact variations in speed — Stationary or Motion control	
Speed Changers	Speed variations up to 375% at the turn of a crank	

Texrope Super-7 V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

A 2429

ALLIS-CHALMERS

Originators of the Multiple V-belt Drive for Industry



Result: Lowest power costs at new synthetic rubber plant with Worthington-Moore turbines

In Canada's new government-owned synthetic rubber plant, operated by Polymer Corporation, Ltd., Worthington-Moore high back pressure steam turbines have permitted considerable savings in power costs. In this, Canada's largest steam plant installation, engineered by H. G. Acres and Company, power is produced as a by-product, since all exhaust steam is used for plant operation.

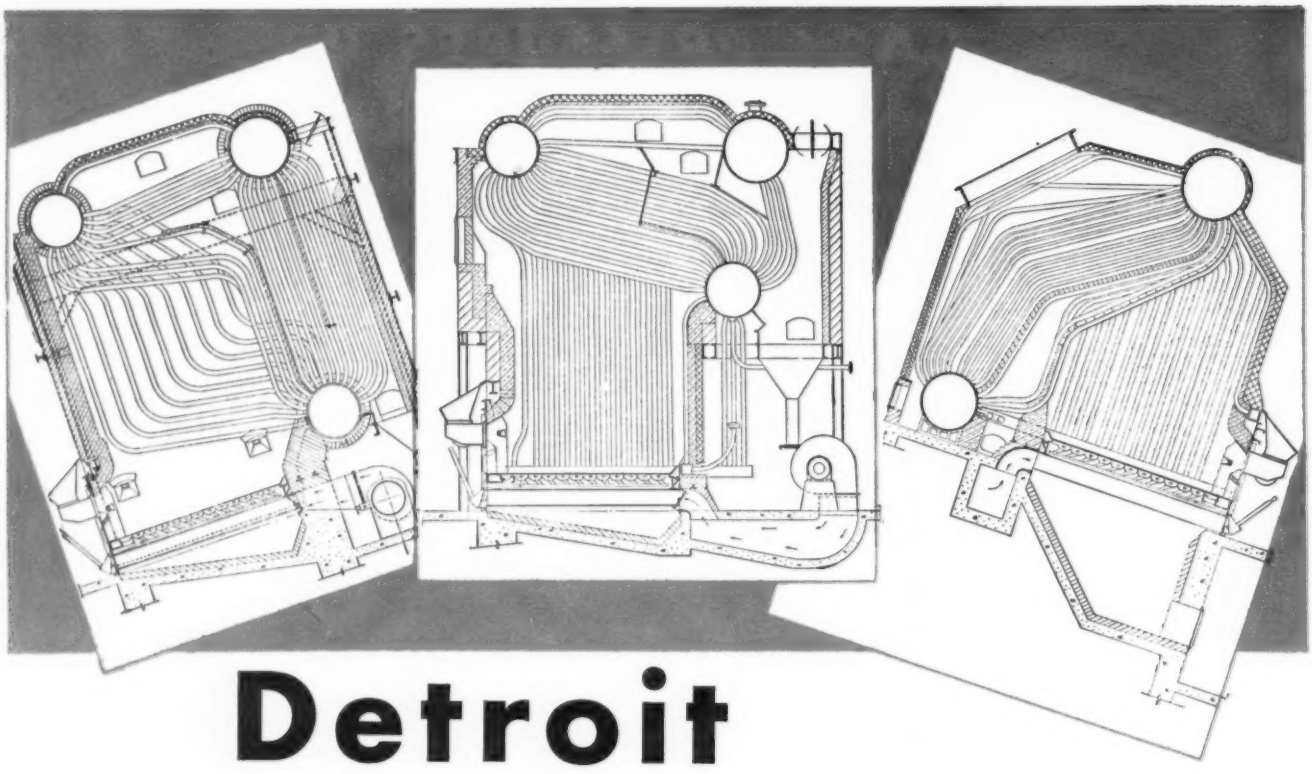
Three Worthington-Moore 1650-hp. geared multi-stage turbines are illustrated above as installed. These topping turbines operate with steam at 400 lbs. initial pressure, 650°F. temperature, and exhaust against 160 lbs. back pressure. Two 1000-hp. Worthington-Moore turbines, exhausting to 220 lbs. back pressure, were also selected.

Save Money in Modernizing Steam Plants

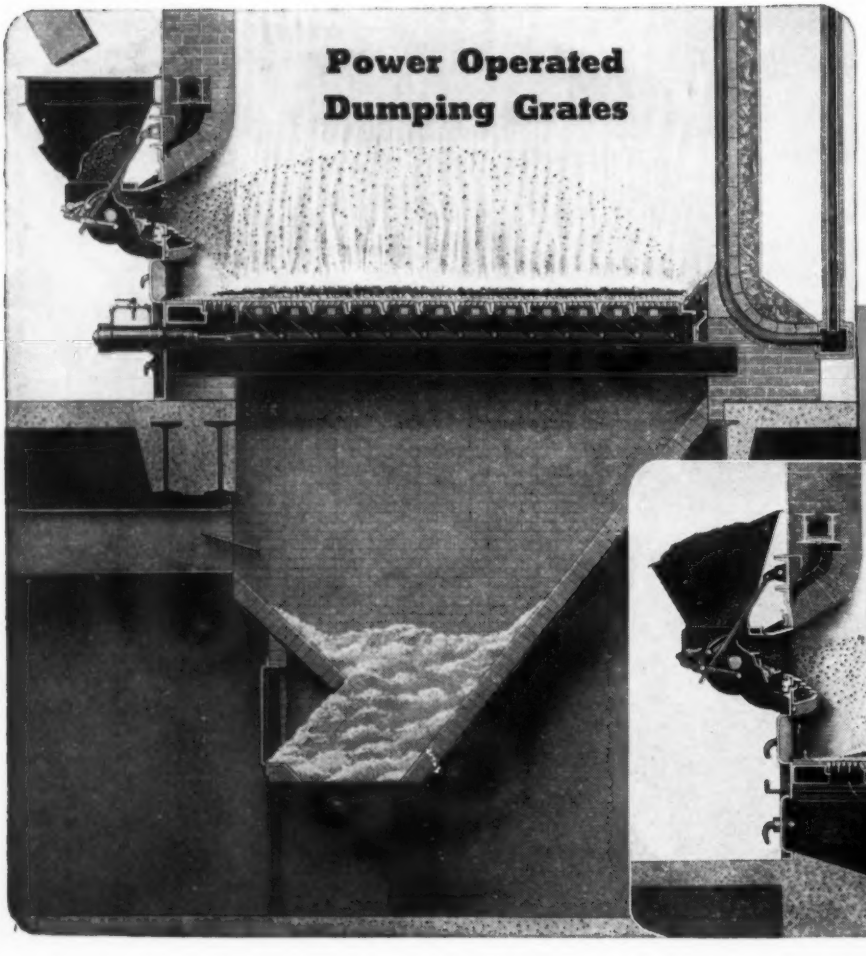
Worthington-Moore turbines operating against unusually high back pressures have enabled many plants to install modern high-pressure boilers without scrapping existing low-pressure apparatus. Write for complete details. *Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, New York.*

WORTHINGTON

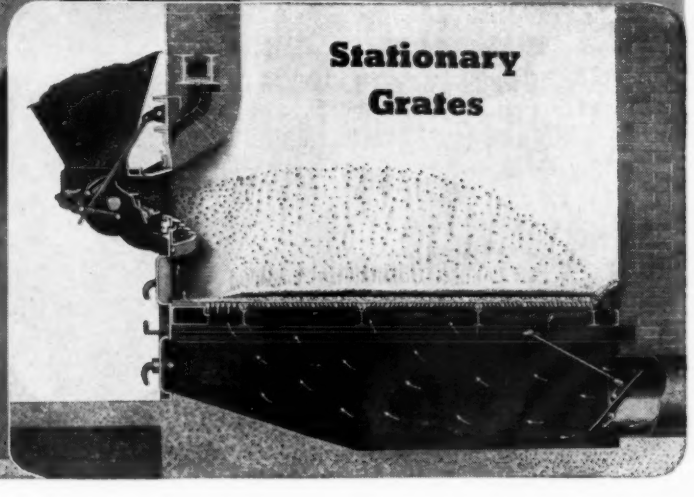
T4-9

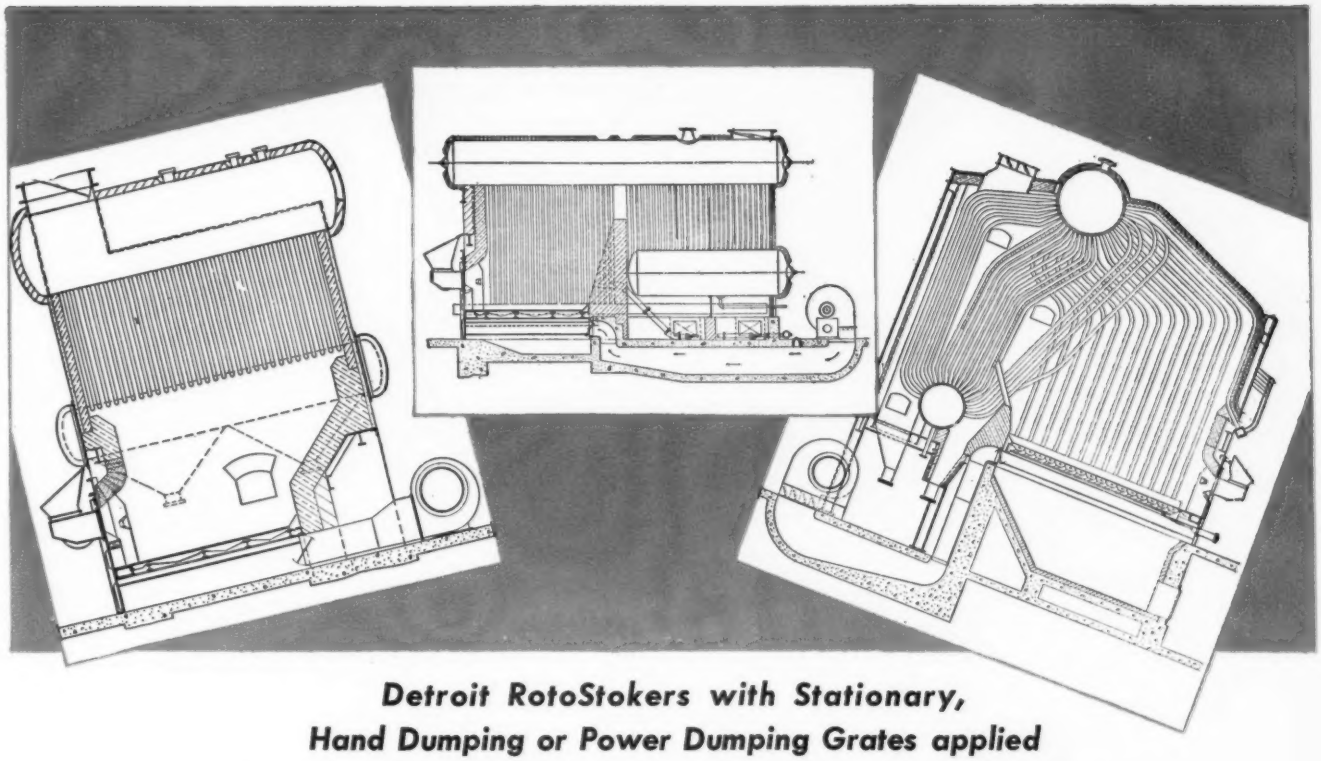


Detroit Stokers... A Record of Success with *All Modern* Boilers



Detroit RotoStoker





Detroit RotoStokers with Stationary, Hand Dumping or Power Dumping Grates applied to several modern boiler types. Spreader stokers that have OVERTHROW Rotors assure dependable and uniform fuel distribution.

In nearly half a century of building many types of stokers, Detroit Stoker Company has had experience with applications to all boiler designs.

Correctly applied Detroit Stokers are successful with all modern boilers. The firing method best suited is recommended. Detroit Stokers will give you longer, more trouble-free service—better fuel economy and permit a wider choice of coal.

Write for bulletins on Detroit Stokers.

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING

DETROIT 2, MICHIGAN

Works at Monroe, Michigan

Detroit RotoStoker

AFTER 10 YEARS SERVICE in this Chicago Soap Plant

Our photographer reminded us that he took these same three pictures more than ten years ago—so we asked the plant engineer and sure enough—these Sarco Steam Traps have never been touched since they were installed. No wonder this company specified: "All Sarco" for its new enlarged plant!

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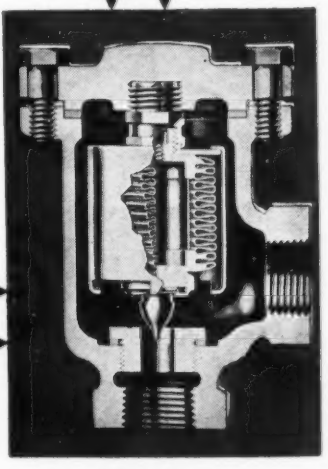
This trap permits the extraction of all the useable heat before the condensate is discharged. Large ports, open when cold—mean quick starting. This trap works satisfactorily on varying pressures and cannot freeze, stick or air bind. Install one on each coil and see what a difference it makes.

THIS IS THE TRAP

that is ideal for all types of process kettles, pans, evaporators, retorts, dryers and presses, and for removing moisture from steam lines. Two pressure ranges, 0 to 125 lbs and 0 to 225 lbs; no seats to change; ½" to 2". Ask for Catalog No. 250.



SARCO No. 9
Thermostatic Steam Trap

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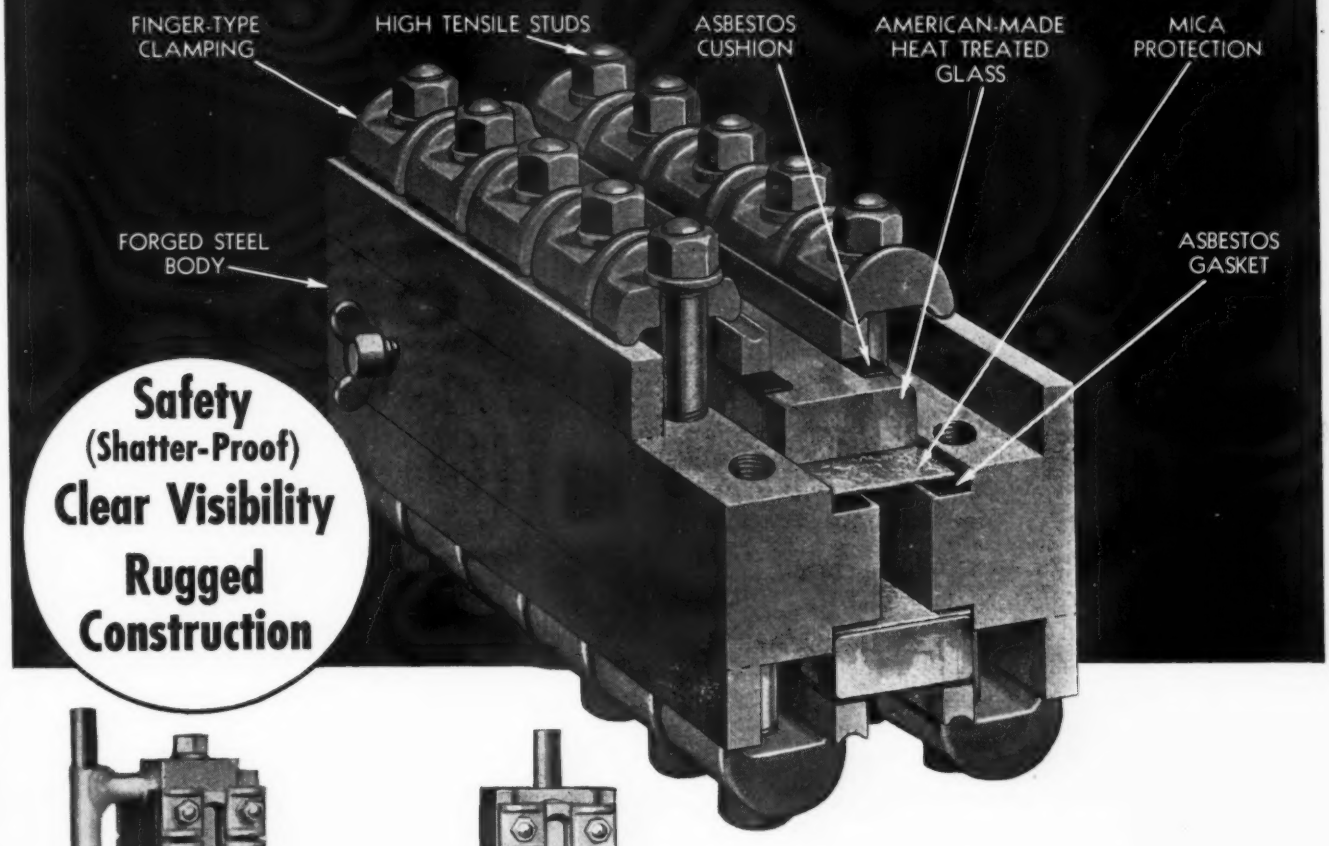
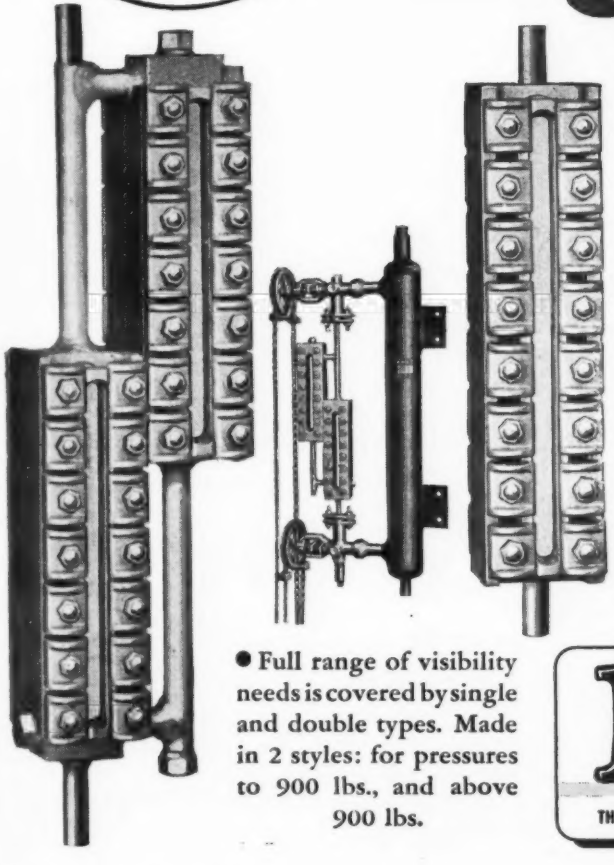
Cut your water gage maintenance with

RELIANCE *Mica-Protected* FLAT GLASS INSERTS



Safety (Shatter-Proof)
Clear Visibility
Rugged Construction



● Full range of visibility needs is covered by single and double types. Made in 2 styles: for pressures to 900 lbs., and above 900 lbs.

Both from the standpoint that the water gages on your boilers are a vital control point *and also constitute a danger point,* you need the sturdiest gage glasses obtainable. And you need clear visibility for mistake-proof reading.

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BOILER SAFETY DEVICES since 1884

Reliance

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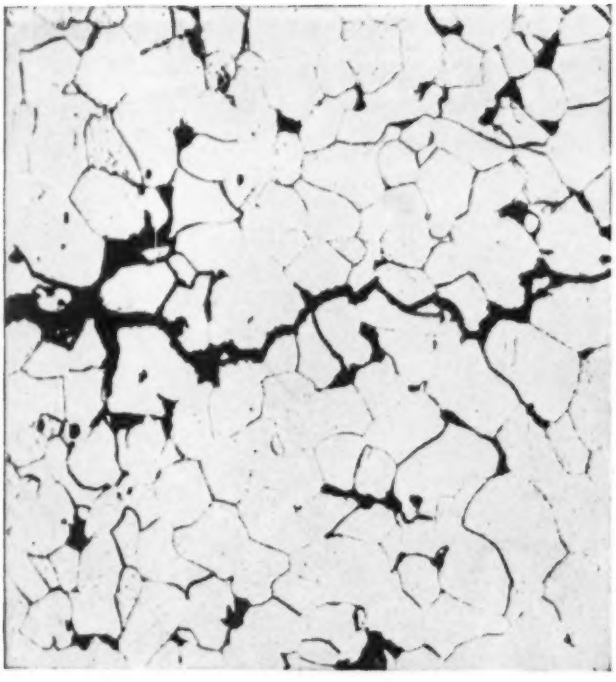
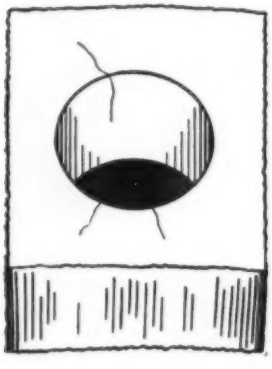


THIS photomicrograph shows the typical intercrystalline cracking which may occur along riveted seams and rolled-in tube ends. Physical conditions which favored its development were stress in the metal and the presence of tiny crevices which permitted the boiler water to concentrate by evaporating to a region of lesser pressure. Overheating was not a factor.



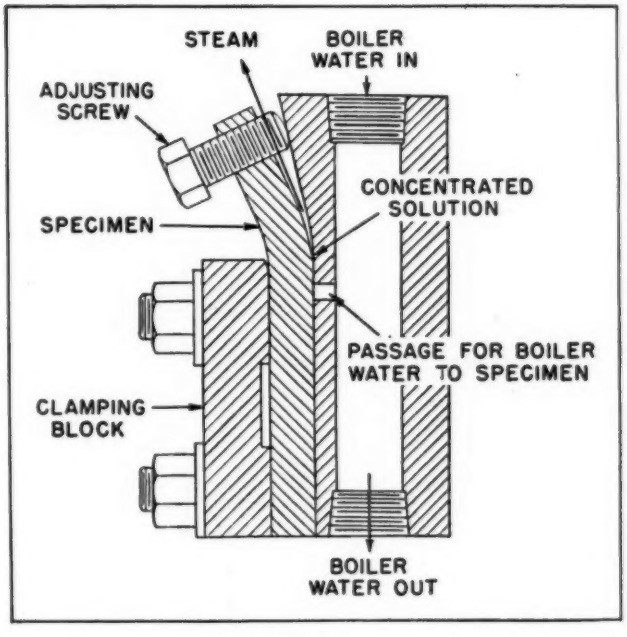
Left: Early stage of cracking at edge of rivet hole.

It is generally agreed that the chief chemical factor in cracking of this type is high alkalinity,

What

hence the name "caustic embrittlement." Maintenance in the boiler water of certain optimum sulfate-alkalinity ratios has been quite widely relied on to combat it.

Hall Laboratories undertook an experimental study of the problem, using embrittlement detectors which were installed on dozens of operating boilers. These detectors simulate the physical conditions under which caustic embrittlement may occur, leaving the boiler water itself as the



Embrittlement Detector

HAGAN
HALL
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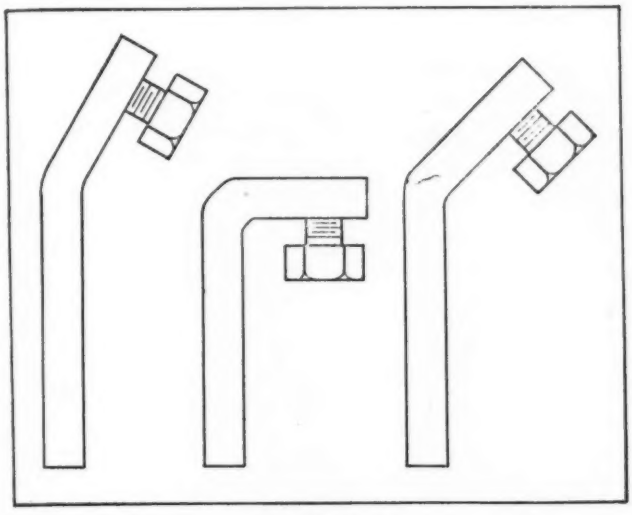
about embrittlement?



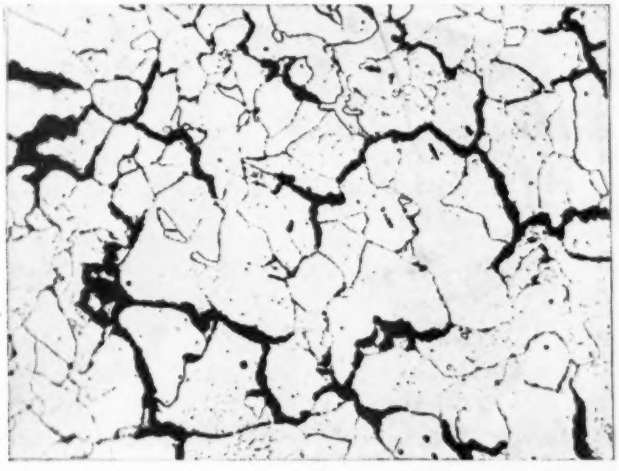
Start of Test | End of test uncracked on further bending | End of test badly cracked

Contrast between effect of non-embrittling and embrittling boiler water on test specimen.

variable. The condition of the steel specimen after definite periods of exposure, is the measure of the embrittling tendency of the water.

This study made it clear that no sulfate-alkalinity ratio is an adequate preventive. It showed, however, that other available procedures can be effectively applied to inhibit this type of embrittlement.

Because it was assumed that concentration of caustic could not occur in the absence of capillary openings such as those in riveted seams, embrittlement was not expected in the modern boiler with forged or welded drums. Actually, however, a distinctive type of embrittlement does occur in the tubes of such boilers, where it is characterized by breakdown of grain boundaries and consequent weakening of the metal over a wide area.



Effective prevention of either type of embrittlement requires that every boiler be considered as a separate problem. In this, as in all other matters related to the industrial uses of water, Hall Laboratories takes all factors into account and recommends procedures which are best fitted to *your specific situation.*

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

HALL LABORATORIES, INC.

(A Subsidiary of Hagan Corporation)

CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

Don't take a chance when you buy *valves*

Fig. 19031 W. E.—Class 900 pound Cast Steel Flangeless Bonnet Globe Valve with welding ends. Spur gear operated. Stellite faced.

Fig. 11365 W. E.—Class 1500-pound Cast Steel Horizontal Lift Check Valve with piston-guided disc, welding ends and new flangeless cap.

Fig. 6003 W. E. — Class 600-pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

Fig. 559—125-pound Iron Body Bronze Mounted Swing Check Valve with flanged ends, bolted flanged cap and regrindable, renewable bronze seat and disc. Disc, when wide open, permits full, unobstructed flow through valve body.

POWELL

Consult the Powell Engineering staff

Naturally you know your business better than any outsider. But your business is not making valves.

On the other hand, Powell has spent more than a century making valves—and valves only. So we believe we know more about valves than anyone else—at least anyone outside the valve making industry.

The result of this knowledge is the most complete line of industrial valves made today.

For services for which Bronze or Iron valves are best adapted, Powell makes every required type and design.

Where something more is needed, especially for higher pressures, Powell Cast Steel Valves of all types are available in pressure classes from 150 to 2500 pounds.

Fig. 11303 W. E.—Class 1500-pound Cast Steel Flangeless Bonnet Gate Valve. Venturi type. Welding Ends. Spur gear operated.

Fig. 19084 W. E.—Class 900-pound Cast Steel Flangeless Bonnet Welding End Non-return Globe Valve. Has compound spur gearing to provide easy operation. Stellite faced.

Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve. Made in sizes 2" to 30", inclusive. Has outside screw rising stem, bolted flanged yoke and tapered solid wedge.

The Wm. Powell Company
Cincinnati 22, Ohio

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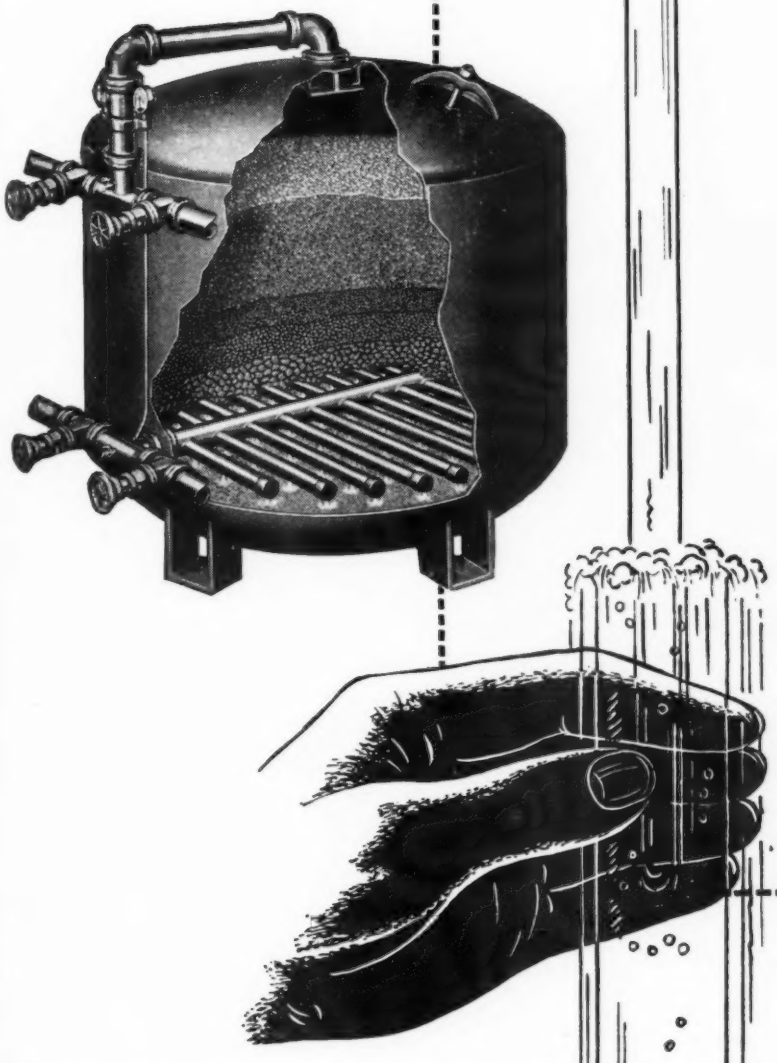

Good Water

COMES FROM GOOD EQUIPMENT!

But good equipment alone may not be a complete solution to your water treatment problems.

CHOOSING the right equipment and the right process for conditioning your boiler feedwater make-up are both of highest importance. Correct application depends on such factors as the character of the raw water, amount of makeup, type of steam load and design characteristics of steam generators and prime movers.

Allis-Chalmers engineers can supply valuable aid in such a selection. They have had extensive experience in conditioning boiler water for both high and low pressure power plants. In addition, their recommendations will be unbiased, because Allis-Chalmers offers a complete line of equipment that includes Hot and Cold Process Softeners, Sodium and Hydrogen Zeolite Softeners, Degasifiers, Deionizers, Chemical Proportioners, Filter Backwash Pumps, and Oil and Water Filters.

For prompt assistance with any water conditioning problem, call your nearest A-C office or write ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 2316

Shown above is sectionalized view of filter tank. Send today for complete details of Hot Process Softeners in Bulletin 28B6611.

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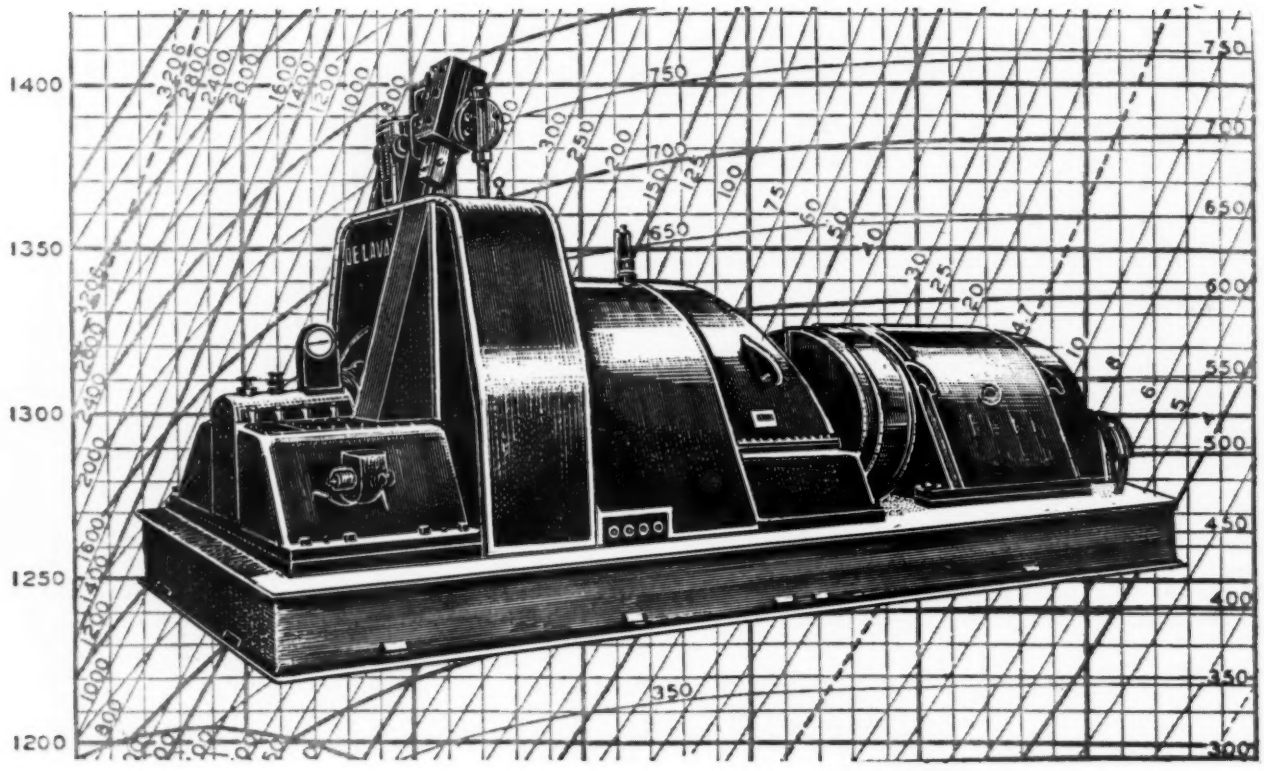
A CENTURY OF SERVICE to Industry THAT MADE America Great



SKIM THE POWER CREAM

from process steam

If you use appreciable quantities of steam consider the economy of generating all or a part of your own power by allowing the steam to expand through a De Laval Turbine before delivery to the heating or processing system.

De Laval Turbines can be furnished with automatic controls designed to make exhaust steam available in the quantities and at the pressures required to meet the demands of plant operation and the requirements of thermo-dynamic economy.

May we have the privilege of submitting cost figures based upon the installation of a De Laval turbine selected to meet your plant requirements? T-7

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MAY 1948 VOLUME 92, NUMBER 5

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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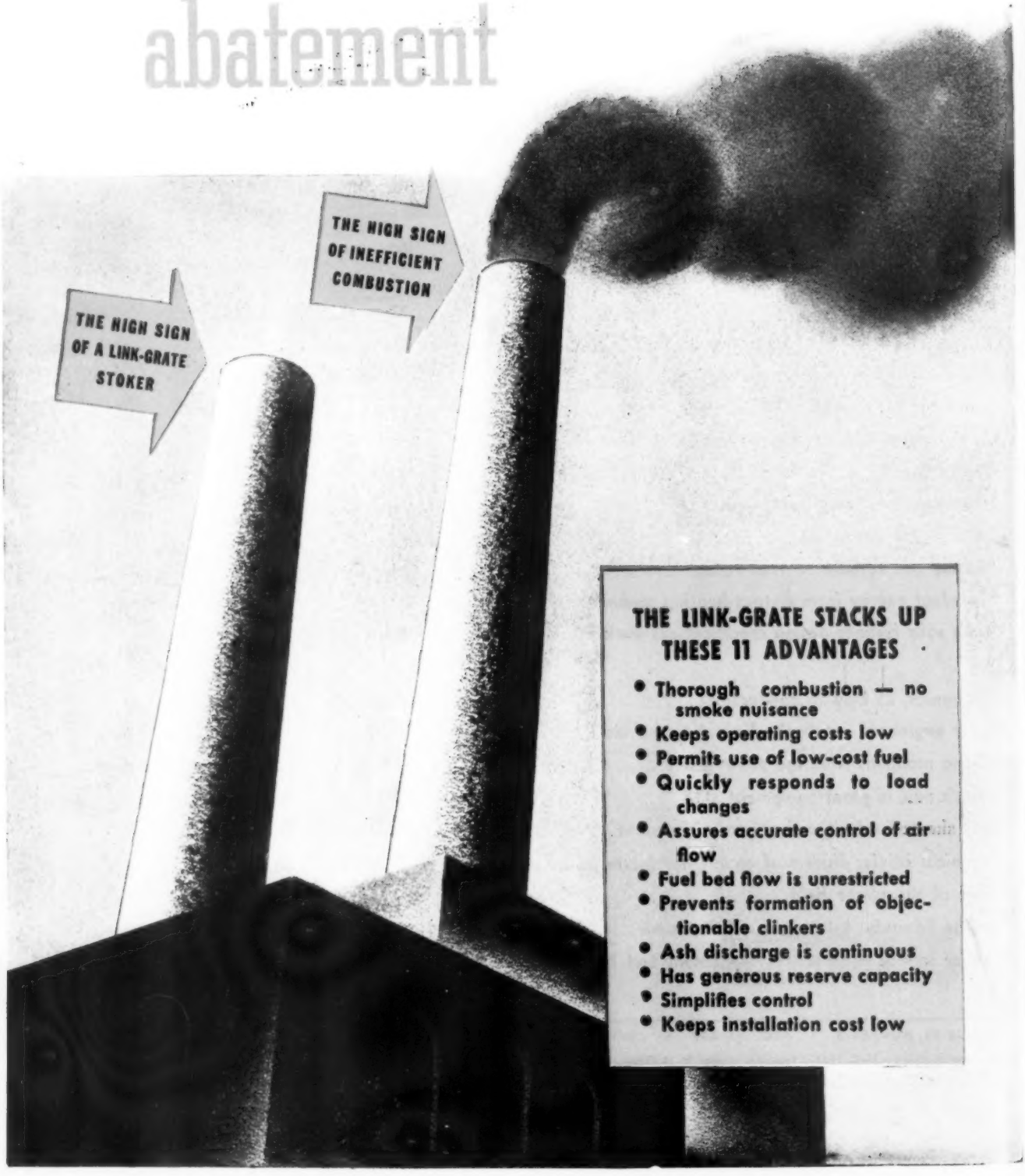
Three cheers for smoke abatement

...from your fuel cost sheets



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- Thorough combustion — no smoke nuisance
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- Assures accurate control of air flow
- Fuel bed flow is unrestricted
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- Simplifies control
- Keeps installation cost low

2...from your Smoke Inspector

3...from your neighbors

Get all 3 with a Westinghouse Link-Grate Stoker

Smoke abatement means much more to you than to an outsider interested only in cleanliness. To you, it means more steam per pound of coal—more of your coal turned into heat, and less of it "up the flue" as soot.

You get these advantages with a Westinghouse Link-Grate Stoker because of its characteristic action. This action maintains a regular combustion rate by continuously processing the fuel bed to keep it porous. With this action, a positive motion at the rear of the stoker permits a uniform flow of coal over the underfeed section, to keep the burning lanes open.

In Link-Grate action, the grates first hinge upward to break open the fuel bed and let low-pressure air flow through the grates. The reverse movement of the grates crumbles and conveys the burning fuel.

Another effect of this Link-Grate action is the continuous ejection of the ash off the discharge plate—to do away with periodic dumping and to reduce labor costs. Clinkers are not a problem.

Since this action keeps the fuel bed always porous, the Link-Grate Stoker can meet suddenly increased steam demands quickly with full combustion efficiency.

Get the complete information about the Link-Grate before you make another investment in stokers. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a user. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-50470

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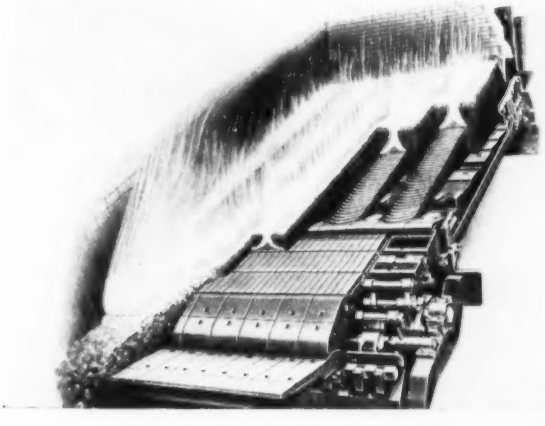

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POWER

PHILIP W SWAIN, EDITOR • MAY 1948 • ESTABLISHED IN 1882

THE ATOM JOB—IS IT BEING DONE?

TODAY, the Atomic Energy Commission carries one of this country's top responsibilities. It is only natural that we, as engineers and citizens, should want to know how well that responsibility is being discharged.

Of necessity, much of AEC's work is secret. The information that can be released is usually fragmentary and difficult for even the expert to evaluate. In such an atmosphere, criticism is all too easy. Yet unwarranted criticism can be damaging in its effects on the Commission and the McMahon Act under which it operates.

To secure the facts needed to assess this situation, POWER, through its Washington bureau, has re-examined the entire atomic-energy program, starting from a background of close coverage of the subject since 1940. We didn't ask for, and didn't get, any secret information. We did talk to government officials, both in and out of AEC, and to industrial leaders, those involved in the atom program and those who have chosen not to be involved. Every major atom plant and lab has been visited.

The report beginning on the following page presents the results of this survey in concise form. It represents, we believe, as complete and clear a picture as is available to an outsider. On the facts, these conclusions about the atomic program under the McMahon Act seem justified:

1. *AEC is, of necessity, pushing first an armament program, and results must be judged on this basis.* One cause for criticism has been the apparent slowness in developing peacetime applications, particularly power generation. The key fact here is that no one in the U. S. needs atomic power very badly. In fuel-hungry Europe, and even more in Britain, the picture is different. Thus the first practical atomic power plant may well appear outside the U. S.

Even with its tremendous budget, AEC must carefully ration materials and, especially, engineering talent. Under today's conditions, AEC must give top priority to military projects, go slow on others that would compete for men and materials.

2. *There has been no faltering in the No. 1 job of running war-built plants to maintain the bomb production achieved by Manhattan District.* At Oak Ridge, efficiency in separation of fissionable uranium has been boosted. Production of plutonium at Hanford has been maintained in the face of great technical obstacles. Bomb manufacture at Los Alamos has been headed from a laboratory toward a factory operation.

3. *No such unqualified endorsement can yet be given to the equally important program for advancing our knowledge of fission processes and products, but we seem to be on the way.* Six months ago, the forward-thrusting phase of atom work was at dead bottom, stagnating. Then AEC got a grip on its huge job and things began to move. Today the situation is still spotty, but visibly on the mend everywhere.

Able regional administrators with a large measure of autonomy are pushing the major projects along. The top-priority new plutonium plant at Hanford is well under way. In the radically reorganized reactor program, designers stand ready-to-go on three or four new piles. Although weaponeering at Los Alamos still has a long way to go, agreement has been reached on a research plan and the laboratory is squaring away to undertake it.

4. *There appears to be no need, at this time, to change the McMahon Act.* When it becomes possible to see the pattern that peacetime commercial application of the atom will follow, we will almost certainly want to reconsider the entire question of the "socialized" atom. With military applications now in the fore, government monopoly is natural. Under the McMahon Act, AEC is getting its job done. Right now that's the prime consideration.

ATOMIC ENERGY

1 Gaseous diffusion plant at Oak Ridge, Tenn., extracts the fissionable U235 from natural uranium, and discards the far more plentiful nonfissionable U238

POWER Reports—Where America

By ROBERT COLBORN
POWER'S Washington Bureau
Photos, courtesy Atomic Energy Commission

▶ NUMBER ONE JOB of the Atomic Energy Commission is to keep the war-built plants running, to maintain the bomb production achieved by the Manhattan District. On this there has been no faltering, no interruption of production.

At Oak Ridge, efficiency in the separation of fissionable uranium has been greatly stepped up. At Hanford, production of plutonium has been maintained in the face of great obstacles.

Equally important with operation of existing plants, for the long haul, is the job of advancing the atomic art.

In military terms, this means: Does the U. S. wait for the rest of the world to catch up with its wartime achievements, or does it push ahead with the development of more and better weapons?

In technical terms: Are Americans learning more about what goes on in the atomic nucleus, about how to control atomic reactions; are the theoretical possibilities being reduced to engineering practice?

The Limping Start. At this level, no such unqualified endorsement can yet be given to the government's program.

Six months or so ago it would have been necessary to report that the forward-thrusting phase of atom work was in a state of near stagnation. Preparations for a new and bigger plutonium plant were enmeshed in engineering and personnel difficulties. Weapons research was at loose ends.

Construction of new types of atomic reactors was being held up by vacillation and indecision in the AEC.

Throughout the atom project morale was low. Many technical people were leaving; many of those who remained were discouraged and uncertain.

But last summer the year-old AEC began to get a grip on its huge job. Things began to improve. Today the situation is still spotty—good here, bad there, but everywhere on the mend.

Now Off Dead Center. The program that AEC has now taken off dead center and is beginning to push along is above all an armament program. The way the world goes now, the commissioners figure that production of bombs takes precedence over everything else.

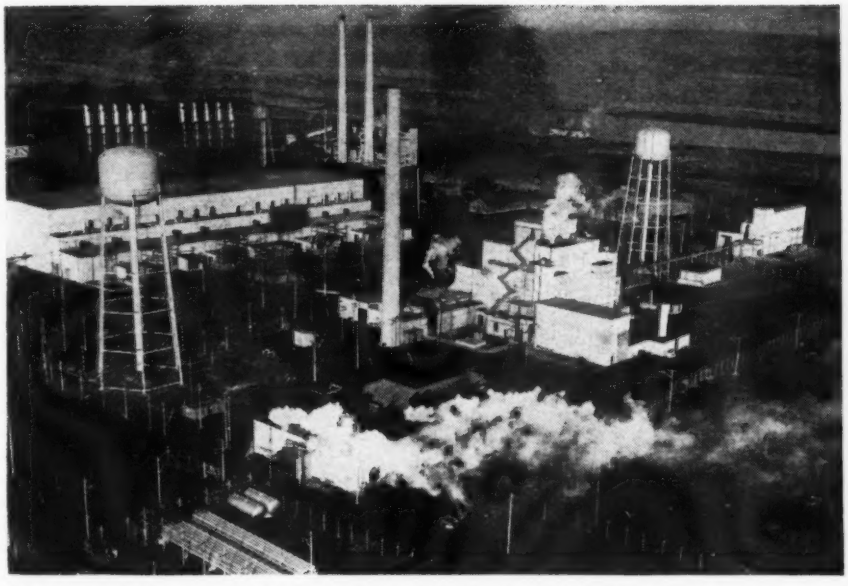
Atomic power problems in general are being tackled in a conservative, step-by-step way. The wartime method of bulling ahead has been dropped.

Not only is AEC's program a military one—it is a rather narrowly military one. Even such projects as atomic propulsion of warships, bombing planes, and missiles are subordinated to production of explosives.

The Atom Plants. The first atomic bomb was completed early in July 1945. It was charged with plutonium and was detonated on the sixteenth at Alamogordo, N. M. Two weeks later a uranium bomb was dropped on Hiroshima, and three days after that another plutonium bomb was dropped on Nagasaki. At that point, the U. S. had exhausted its supply of bombs.

For nearly three years, since then, the atom bomb plants have been running day and night building up a stockpile of bombs. How fast? People who have any information refrain from guessing. But a common view among men who only know what they read in the Smyth Report is that talk of production rates in the hundreds or thousands of bombs is fantastic.

Whatever the rate actually may be it is scheduled to be maintained until late next year or early 1950. At that time, new facilities at Hanford, Washington, will begin to bring in additional production. By 1952, when these facilities are completed, total bomb production should be substantially increased.



2 One of the main production areas in the Hanford Plutonium factory. Its process converts the plentiful U238 into the fissionable element known as plutonium

Is America moving ahead on atomic energy? Facts are hard to come by. Production rates, costs and resources are all 'top secret'—even the nature of problems ahead and technical reasons for policy decisions are, too. In this situation, our Washington Bureau reexamines the whole atomic-energy program. We think we have as clear a picture as is available to an outsider

Stands in 1948

The U. S. came out of the war with a bomb industry consisting of four major plants: two at Oak Ridge to separate the natural explosive, uranium 235; one at Hanford to produce the synthetic explosive, plutonium; one at Los Alamos to assemble bombs using these explosives.

Oak Ridge Plant. In plant K-25 at Oak Ridge, uranium, combined with fluorine to form a gas, is forced through thousands of stages of porous membranes. The lighter fissionable isotope, U235, goes through the "sieve" a little more easily than the heavier U238. So what comes out at the far end is enriched U235.

K-25 has been by far the most successful of the atom plants. Almost from the start it ran without serious difficulties. Nevertheless, AEC holds that, technically, K-25 is a blind alley. For one thing, K-25 is the most expensive and difficult to build of all the plant types. More important, it is intrinsically wasteful of nuclear fuel. It extracts the naturally fissionable 0.7% from uranium and discards the nonfissionable U238.

The Hanford process, on the other hand, offers the promise of utilizing the plentiful U238 by transmuting it into the artificial, and fissionable, element plutonium.

So there are no plans for additional facilities of the K-25 type. But K-25 itself will be kept running indefinitely —certainly as long as accumulation of bombs has a top priority. And even after that, there'll be uses for concentrated U235. Production of enriched fuel, for instance, for reactors.

What About Hanford? No such postwar increase in output has been achieved at the third explosive plant—the Hanford Engineer Works. As a matter of fact, it is a technical miracle that production has been held up to the wartime level.

The three Hanford units utilize processes that had never occurred on earth until December, 1942.

At Hanford no effort is made at the tough separation of U235 from U238. Instead, the U235 is "burned up" in a chain-reacting pile. In its burning, it transmutes a little of the inert U238 into another element, plutonium, never found in nature.

Plutonium is fissionable. And—very important—it differs chemically from uranium. So then the plutonium can be separated by comparatively straightforward chemical methods.

Each of the Hanford piles is essentially a stories-high block of ultra-pure graphite encased in some feet of concrete shielding. Into this block are inserted slugs of metallic uranium sealed into aluminum cans to protect them from corrosion. A fission chain reaction takes place in the U235 content of the uranium.

After a while, the uranium slugs are removed, dissolved in acid and put through a series of precipitations and resolutions which finally separate out the plutonium—the end product of the process.

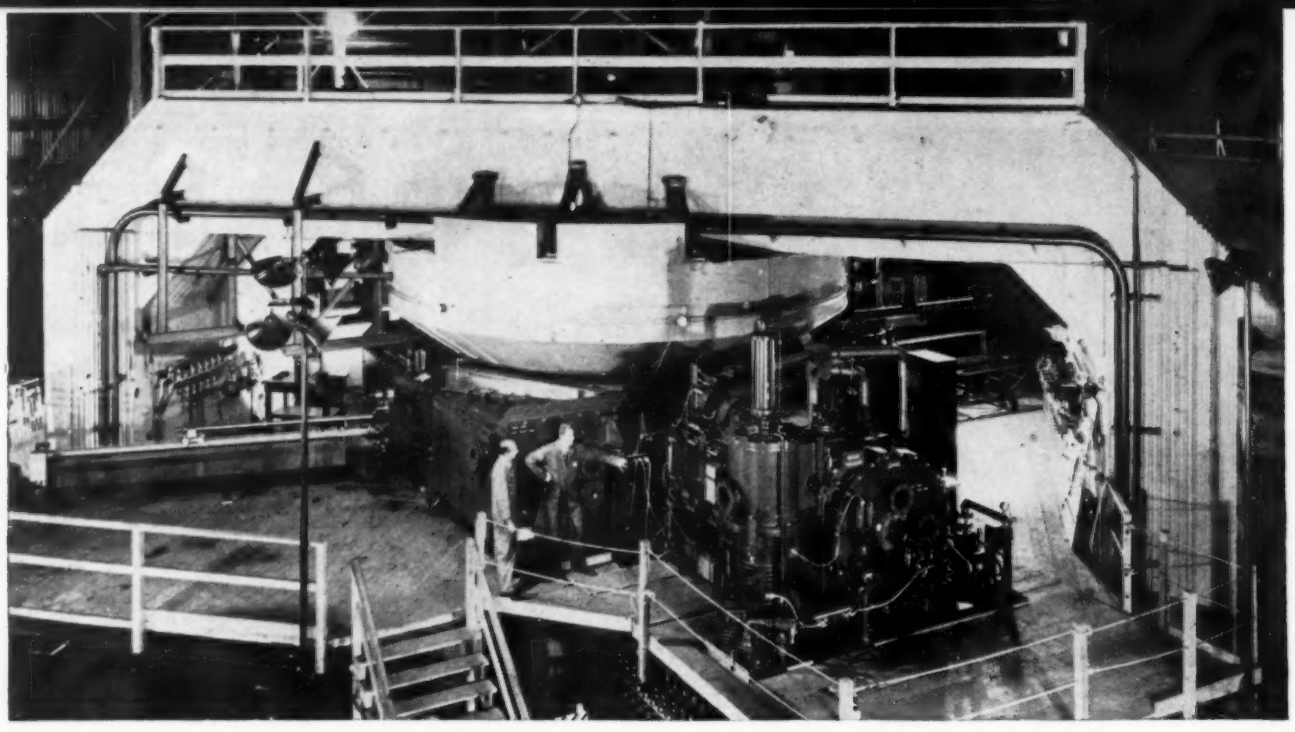
The plutonium leaves a problem behind it—in the form of tons and tons of a mixture of working chemicals, water, uranium and fission products. These last possess radioactivity, which takes years to die away and is so intense it breeds contamination to the point where the whole mass must be handled from behind lead or concrete.

At present this deadly mass is simply stockpiled for later extraction of the uranium. But proper storage is tough. For example, leakage could contaminate the water supply of a whole region, but AEC is confident that the measures it takes obviate any danger.

Despite all its difficulties, the plutonium process is the one on which everyone banks for the future. So AEC has started a tremendous expansion program at Hanford as its major move to step up bomb production.

One part of the program is just to modernize the three existing units—particularly, one assumes, in their chemical phases.

New Plutonium Plant Planned. But the really big job is the construction at the Hanford site of a complete plutonium plant. The new plant isn't going to differ fundamentally from the old one. It'll use fairly conventional graphite-moderated piles with natural,



3 World's greatest "atom-splitting gun" for research is this giant cyclotron at Berkeley (Univ of Calif.) Charged sub-atomic particles whirl at astronomical speeds in chamber under upper 184-in. polepiece. Huge magnet weighs thousands of tons

rather than enriched uranium. Most important, the piles will run cold rather than at a high temperature, which would permit utilization of their tremendous power output—even though this means throwing another million kilowatts or so (as heat) into the Columbia River.

On this job, AEC's overriding objective is a quick and sure increase in plutonium production, with no chances taken. Advancement of the nuclear art is a very secondary objective.

Construction of the new plant at Hanford was one of the first decisions made by the Atomic Energy Commissioners when they took over from the Army. But through much of last year, the project was seriously bogged down.

Last September the bottleneck was broken. General Electric Co subcontracted the design of the chemical separation plants to Kellex Corp, the M W Kellogg subsidiary that designed K-25 at Oak Ridge. At the same time another subcontract was placed with Standard Oil Co (N. J.) to work out alternate designs for several particularly tricky phases of the chemical plants. Still a third alternative is being explored by the Clinton Laboratory at Oak Ridge.

Today, design is well advanced. GE's construction subcontractors already have preliminary work under way. By the end of the year construction will be going full blast, and it'll continue at a high rate until it begins to taper off in 1951. Material procurement for the new plant is already moving.

HOW ABOUT ATOM POWER?

The key fact about development of useful power from atomic energy is that no one in the U. S. needs atomic power very badly.

What atomic energy could provide in the near future, most technicians guess, is a practically unlimited source of electric power which would be a little cheaper, perhaps (at the busbar) than power from coal—more expensive, almost certainly, than hydroelectric power. Its more peculiar economic characteristic would be that, as far as fuel is concerned, it would cost about the same anywhere—on top of the Andes or in New York City.

No Urgent Need. In a nation that possesses a 2000-year reserve of coal, such a prospect is not terribly exciting—economically speaking—to anyone outside the fuel business. Conceivably, it might change the cost factors in plant location of some U. S. electro-process industries—moving them closer to raw materials or markets. However, the University of Chicago's Cowles Commission, which has been making a study of transportation-free 4-mill power, thinks not.

It is considerations like these, rather than technical factors, which set the time scale for useful atomic energy. You can find competent technical people who are confident that on a work-it-out-as-you-go-along engineering basis they could deliver to you, if you wanted it, a commercial-size reasonably economical power plant along about 1952.

But the AEC doesn't want it much. The commission is scheduling its power work to produce an economic plant some time around 1960. Throughout the Sixties it looks for steady installation of additional plants, so by 1970 atomic energy might be supplying 20-25% of the country's power needs.

Atom Plants Abroad? The rest of the world, however, is not likely to be so casual about power possibilities. The Cowles Commission thinks that on the central European plain—the Balkans and western Russia—there's a combination of developed industry, fuel scarcity, and expensive transportation that makes atomic power attractive.

The coal-starved British, who have budgeted about $120 million for atom work, are believed to be stressing power development in their program.

So the first substantial power plants may well appear beyond U. S. borders.

The one exception to U. S. indifference about power plants may turn out, curiously enough, to be the Air Forces. Their Nuclear Energy for Propelling Aircraft project is built on the long-jump psychology that went from a wiggle on an oscilloscope in 1939 to Hiroshima in 1945. With Fairchild Engine and Airplane Co as principal contractor, the object is to try to build right away an atomic power plant for an airplane.

Pile—Present and Planned. The only nuclear reactor in existence today that is capable of delivering its energy output in usable form is the fast neutron reactor at Los Alamos, N. M. This

unit is fueled with pure plutonium, employs no moderator, is essentially a controlled bomb.

This reactor, which went into operation in November 1946, delivers its energy at a fairly high temperature, one suitable for power generation. It is described at Los Alamos as "a watch-charm model of a power plant."

The second high-temperature pile due to come in is one at the Brookhaven National Laboratory on Long Island. This pile is now under construction and should be completed next year. It may actually deliver a little electrical power; AEC hasn't decided yet.

The decision is more a public relations than a technical one. The Brookhaven pile is simply a quickly designed tool to produce neutron beams and perform irradiations. It is pretty much a copy of the existing pile at Oak Ridge—air cooled, carbon moderated, fueled with natural uranium. It will operate at a higher power level, however, than Oak Ridge's 1000 kw, and its cooling air will emerge hot enough to generate steam. The limit on its temperature is the heat-resistance of the aluminum jackets that protect the uranium from corrosion.

Space is being left in the design for a heat exchanger. But any power generated won't even be enough to run wind-tunnel-size blowers that force cooling air through the pile.

The first reactor that can reasonably be considered a pilot plant for power generation is the Zinn pile at the Argonne National Laboratory in Chicago. Construction work on this only awaits final AEC approval. As a matter of fact, Argonne was ready to start a year ago. It will take a year and a half to two years to build.

The Zinn pile's primary purpose will be research, but it is being designed to do a workmanlike job of getting the power out in usable form. It will be a fast-neutron reactor using concentrated fuel, will operate at a fairly high power level, and at a temperature comparable to that of a steam plant.

Two reactors specifically designed to produce electrical power are on the AEC docket, but neither is in a very active condition. One is the Daniels pile, first projected by the Manhattan District in 1946, and then scheduled for completion this year.

The other straight power project is the General Electric reactor scheduled to be built at the Knolls Atomic Power Laboratory near Schenectady. No information has been furnished about this pile except that it will eventually run at a high enough power level to provide a practical demonstration of the operating problems to be expected in a commercial-size plant.

During the past year a number of the technical problems standing in the way of power production have come close to solution.

Pile Technology. On the problem of heat-transfer fluid, of which much was heard a year ago, it now looks as if the Smyth Report's suggestion of liquid sodium, alloyed with potassium to lower its melting point, would turn out well. Sodium doesn't absorb neutrons, does not become seriously radioactive, has good thermal properties. It does react violently with water. However, a special heat exchanger—complicated but workable—has been developed to obviate trouble from this source.

Nor does the problem of structural materials for reactors now look as appalling as it did a year ago. Metallic titanium is being considered as a major load-carrying material that could resist pile temperature, which may eventually run as high as 2000 to 2500 deg F, some think.

AEC metallurgists are studying structural properties of a lot of unfamiliar metals, such as beryllium and zirconium, that in the past have been interesting mainly as alloying agents. Some of these have nuclear properties that make them valuable in themselves.

Some of this work is already producing valuable byproducts. Discovery of ways to roll and extrude beryllium, for instance, has resulted in improved windows for X-ray tubes.

Similarly, the elaborate chemical engineering studies involved in the design of the new Hanford plutonium plant are expected to work out separation methods basically applicable to power plants as well as to plutonium producers.

Fuel Breeds Fuel. During the past year, too, declassification of information on the breeding problem has clarified one fundamental question: Is nuclear fuel so scarce that atomic energy must always be regarded as a special-purpose affair to be rigidly conserved? Or is it plentiful enough to be regarded as a major power resource?

Uranium itself is a fairly plentiful metal, but only one part in 140 is naturally fissionable. If that were all, atomic energy would soon be a rarity.

But when fissionable U235 is consumed in a reactor, producing power in the process, some of the U238 is transmuted into fissionable plutonium. This increases the supply of fuel.

Then the question is: When you burn a pound of U235, how much plutonium do you get? Suppose you got only half a pound. Burning that half pound would produce a quarter pound, and so on. You'd end up able to use only one part in 70 of the total uranium. Still not good.

But suppose you get a pound of plutonium out for each pound of fuel burned. Then you can eventually utilize all the uranium. And if you could get out more than a pound of plutonium, you'd have a "breeder pile" that would constantly produce extra fuel for use in other piles.

The same question applies to thorium, which is more plentiful than uranium. Exposed to a chain reaction, thorium is transmuted to fissionable U233. If one-to-one breeding is possible, this fact adds thorium to the potential energy supply. Otherwise it is just a scientific curiosity.

What About Thorium? So what about breeding? Theoretically, it is possible. When a U235 atom splits, it throws out, on the average, something over 2.2 neutrons. One of these is needed to split another U235 atom and keep the chain reaction going. If another neutron is used to transmute a U238 atom into plutonium, that leaves a margin for losses—if the losses are small enough.

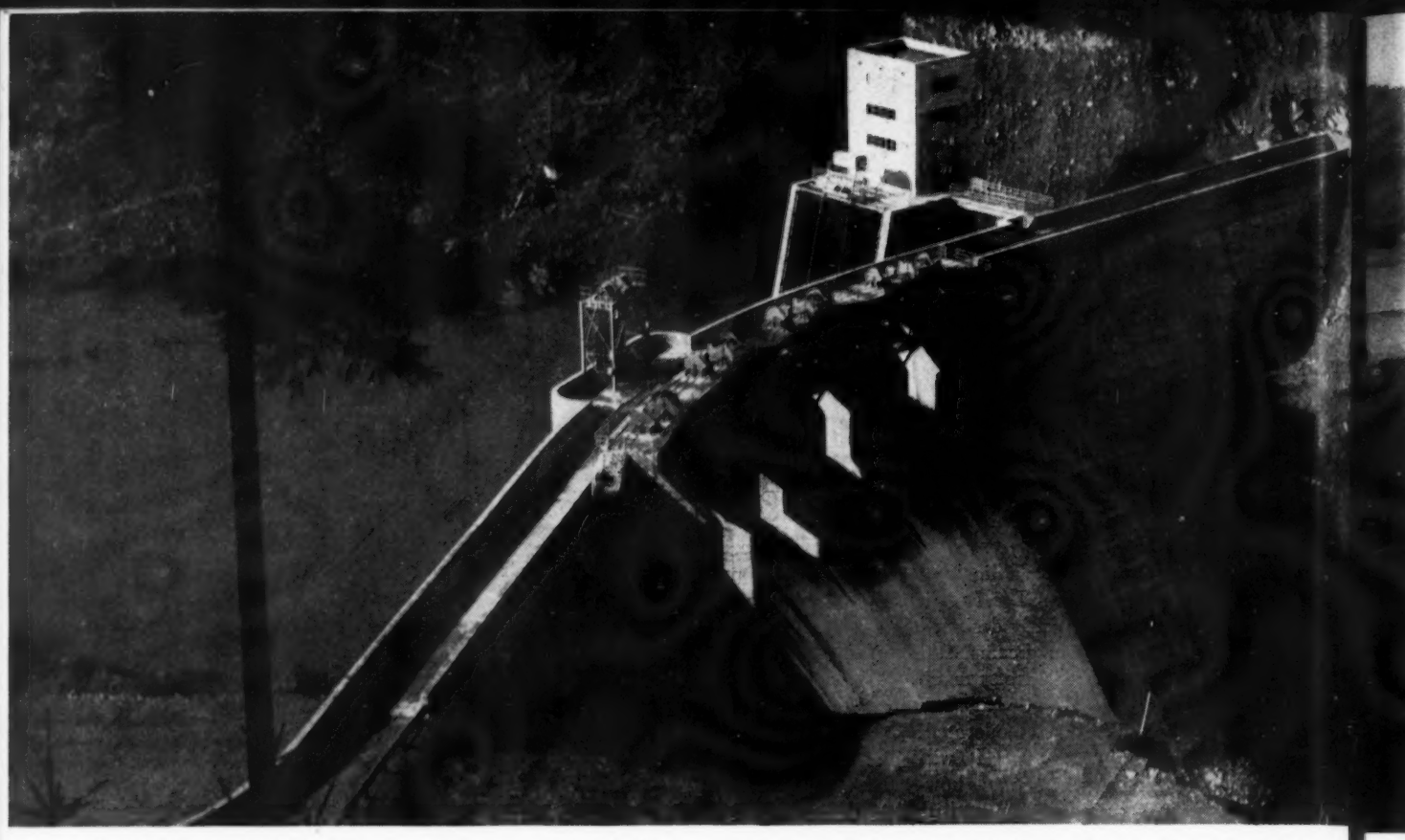
AEC's guarded comments indicate that in present piles the neutron losses are too great to permit breeding. But it is believed that the new piles now on the drafting board would be efficient enough to breed fuel.

If it works out, that makes atomic energy a thousand-year resource.

NONMILITARY DIVIDEND

One immediate nonmilitary dividend from the atom program is the availability of cheap, plentiful radioisotopes ("tagged atoms"), basic tools for measurement and observation. They are being used today in nearly every branch of science and, increasingly, in wide areas of industrial experiment.

To cover out-of-pocket cost to the government, AEC makes a nominal charge for the isotopes. For cancer work, they are furnished free.



1 **LA GRANDE DAM,** 1.5 miles downstream from Alder is essentially a diversion for La Grande tunnel. Height, 215 ft; crest length, 500 ft; base thickness, 165 ft. Assuming 25-ft operating range, dam forms 1060-acre-ft regulating reservoir

Redeveloping Old Hydro Project Ups

When Tacoma, Wash. needed more power it redeveloped its site on Nisqually River by installing 90,000-kw more capacity in two plants and adding water storage that more than tripled kwhr generation. Units connect direct to stepup transformers

▶ DURING THE 54 YEARS that Tacoma, Wash. has operated its electric power system, the capacity has grown to 238,000 kw. Of this amount, 204,000 kw are in four hydroelectric plants, and 34,000 kw in two steam plants, the latter being held in cold emergency reserve. Latest additions are the 40,000-kw La Grande and 50,000-kw Alder plants, which are jointly known as Nisqually No. 2 power development. The last generator was placed in operation May 5, 1947.

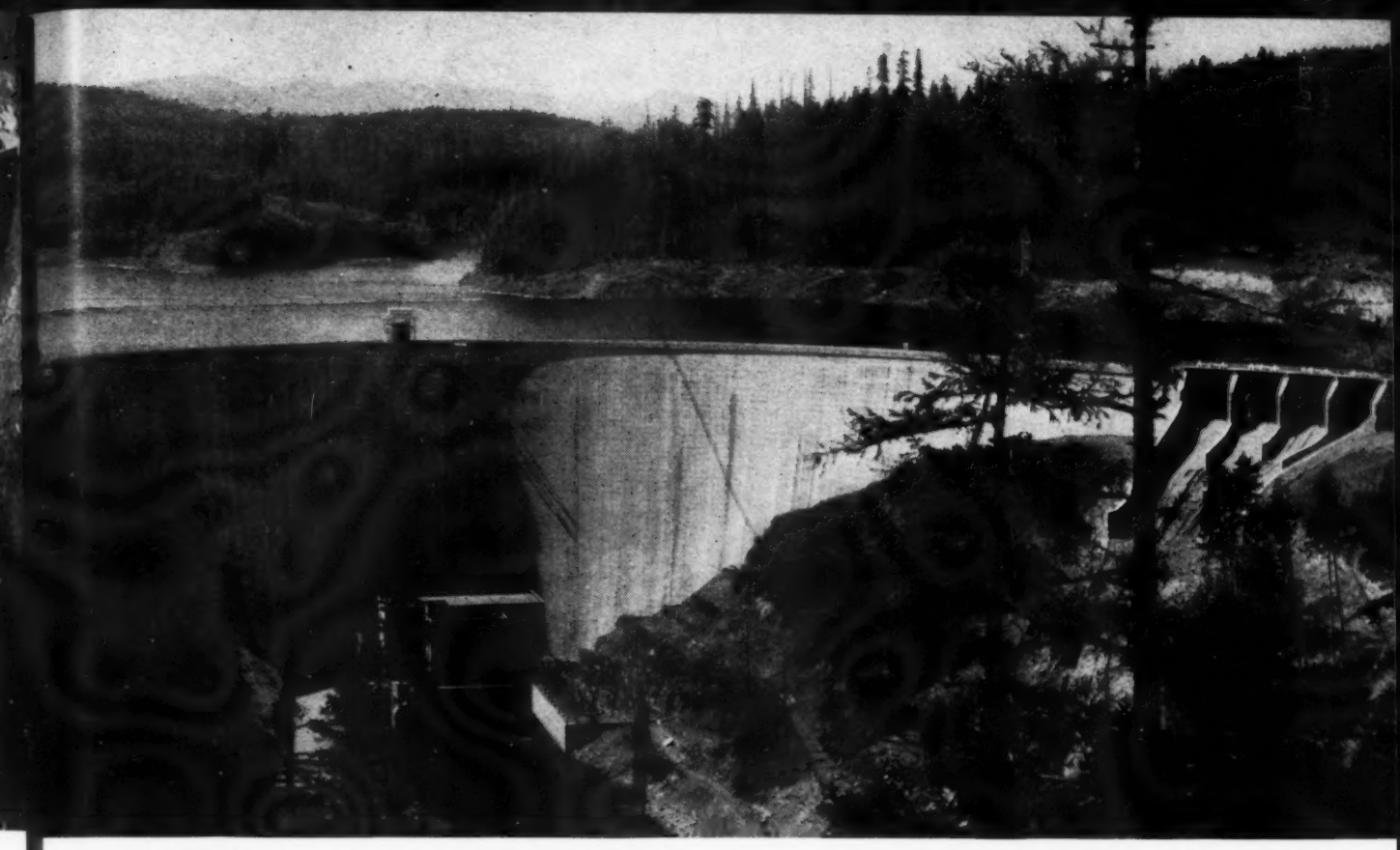
Tacoma's Hydro System. Before considering this project, here's a general picture of the city's hydro system and how it ties into the Northwest power network. Tacoma is fortunately located in regard to hydroelectric power. All four of its plants have been developed within a radius of 35 miles from the center of load, which is one reason why the city enjoys the lowest power rates in the U. S.

This system ties into the Northwestern power pool that includes eleven of the largest private, municipal and federal government utilities in the five Northwestern states of Washington, Oregon, Idaho, Montana and Utah. When the generating equipment on order for this pool is installed it will have a capacity of nearly 5,000,000 kw. Surplus energy of one system is made available for sale to the others, thus reducing the use of high-cost power from fuel-burning plants.

At various times, because of insufficient hydroelectric capacity, the city has purchased power for part of its load, which has had a continuous growth, averaging 10% per year. Cost of power bought from other utilities is higher than that produced by the city's own plants. Purchase is economical up to a given point, however, because of the savings in investment and operating costs.

Because of continued demands for low-cost power, engineering recommendations made in 1938 favored expansion of the city's hydroelectric capacity. Studies of several sites culminated in the selection and development of what is now known as Nisqually No. 2 power development. Contracts were let for the construction of this project in April and June 1942, but because of the war the first generator did not go into service until late in 1945; construction was completed in April 1947. This addition makes the capacity practically sufficient to supply the city's load of 900 million kwhr per year.

The site of the new development is that of the old 24,000-kw La Grande plant built in 1912, 30 miles southeast of Tacoma. This plant has four 6000-kw horizontal-shaft units driven by 8000-hp



2 **ALDER DAM** and powerhouse form largest single unit in Nisqually No. 2 development. The dam, a variable-radius concrete structure, 330 ft high, 1500 ft long, 120 ft thick at base, forms a storage reservoir of 210,000 acre-ft capacity

Output From 150 to 500 Million Kwhr

francis turbines operating under a 415-ft head. Redeveloping this site changes La Grande from a stream-flow to a storage plant and increases its output, including that of the Alder units, from 150 kwhr to 500 million kwhr per year.

Alder Dam. As shown in Fig. 3A. old La Grande development included a low diversion dam and intake about two miles up river from the power plant. The dam diverted water into a 2-mile tunnel and pipeline leading to a regulating reservoir. From this reservoir four penstocks, led to an equal number of main generating units in the power plant and one penstock served the two service units, Fig. 3C.

In the new development, Fig. 3A and B, Alder Dam floods out the old La Grande diversion dam and forms a reservoir of 210,000 acre-ft storage capacity, of which 158,300 are usable on 86-ft drawdown. Maximum normal reservoir elevation is 1200 ft with extreme design flood level at 1207.

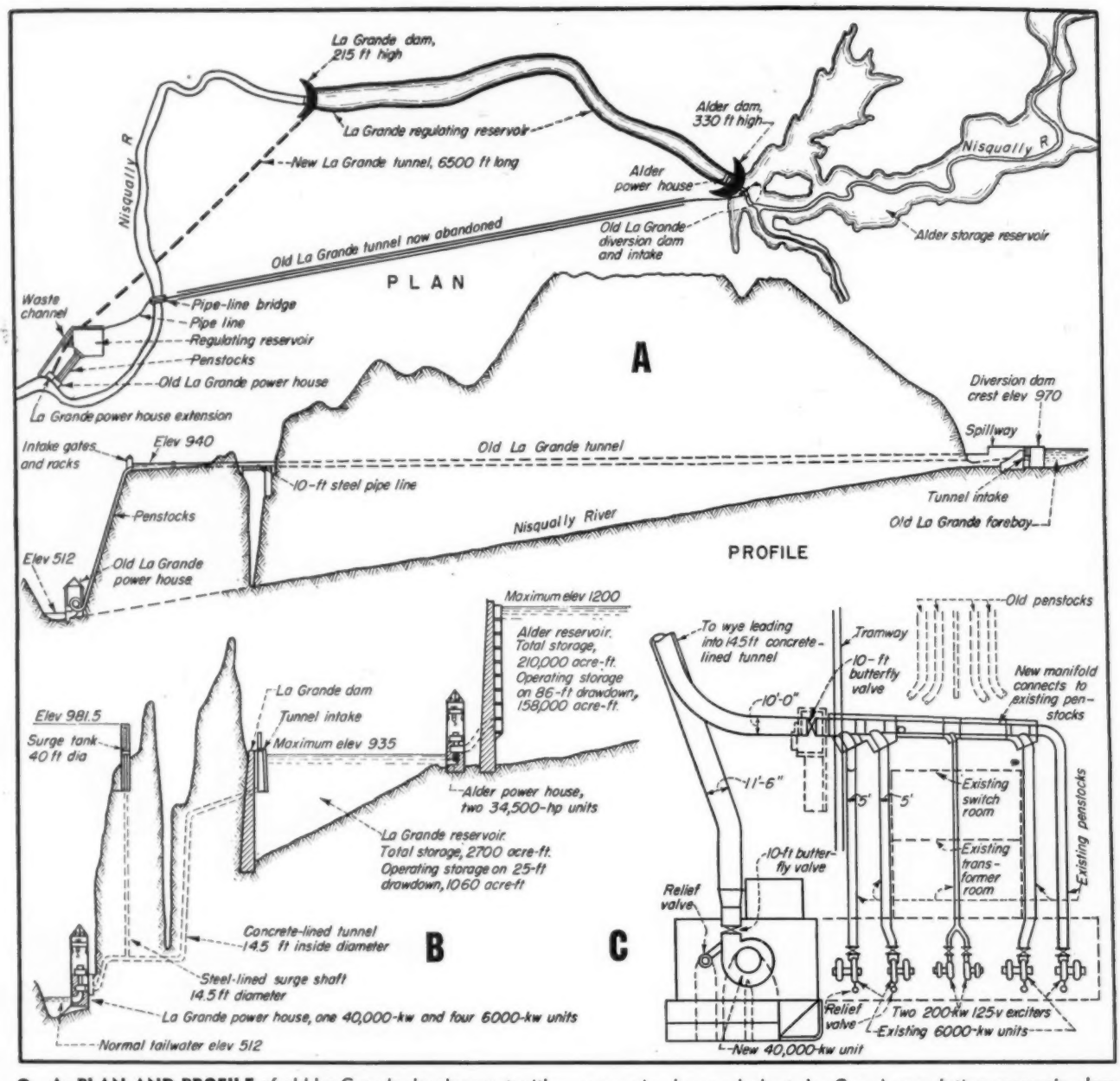
This dam, the largest single unit in the project, is a variable-radius structure containing 420,000 cu yd of concrete. It is 330 ft high, 1500 ft long, 120 ft thick at its base, and 15 ft thick at the top. Here there is an 11-ft road and walkway. An overflow spillway with four tainter gates, each 32 ft long by 23 ft high, provides flood protection. Rated 75,000 cfs, the spillway has a capacity equal to three times maximum recorded flood.

Alder powerhouse, immediately downstream from the dam. Fig. 2, 3B and 4, has two Pelton 34,500-hp francis, vertical-shaft turbines designed for a 178- to 273-ft head range. Each connects to the upstream face of the dam, at center-line elevation 985, by a 10-ft-diameter steel penstock. A 6.5-ft river outlet pipe with its upstream center line at elevation 972.5 also passes through the dam near its base, Fig. 4. Discharge from this pipe is controlled by a regulating valve below the downstream face of the powerhouse. Penstocks and outlet pipe are protected by emergency bulkhead gates and trash racks at the dam's upstream face and each turbine's scroll case connects to its penstock by a 10-ft butterfly valve.

La Grande Dam. Downstream 1.5 miles from Alder, La Grande Dam, Fig. 1 and 3A, is essentially a diversion for La Grande tunnel. It forms a regulating reservoir of 1060 acre-ft capacity, assuming 25-ft operating range. This dam, 215 ft high with 500-ft crest length is 164 ft thick at its base, 12 ft at its crest and contains 85,000 cu yd of concrete. Of gravity design, the dam curves slightly at its top to converge the water flowing over the spillway so it won't slop over the training walls. Located in the dam's center portion, the spillway is controlled by four tainter gates also of 75,000-cfs capacity.

A 14.5-ft concrete-lined tunnel, 6500 ft long, leads from above the dam to the new powerhouse that forms an extension to the old one, Fig. 3A and B. Trash racks operated with traveling hoists protect the tunnel's entrance, and caterpillar gates regulate water flow into it.

Near the lower end of the tunnel a steel-lined 14.5-ft surge shaft rises 280 ft vertically to a plate-steel differential surge tank, 40 ft in diameter and 113.5 ft high. This tank is sunk for half its height into the bluff's top, 400 ft above



3 **A: PLAN AND PROFILE** of old La Grande development with Nisqually No. 2 project superimposed on plan. New Alder and La Grande dams eliminate old La Grande tunnel, which is replaced by new 14.5-ft one, 6500 ft long—dotted lines **B: ELEVATION** through new development shows Alder storage reservoir, dam and plant, La Grande regulating reservoir, dam, tunnel, surge tank (40-ft dia, 113.5-ft height), powerhouse **C: TUNNEL AND PENSTOCK** connections to the old and new generators. On the old units, the penstocks were first cut in two, and then connected to a manifold from the new tunnel

the river, Fig. 3B. Plate thickness in the tank varies from ¾ in. at its bottom to ⅜ in. at the top. Inside the tank the internal riser pipe is 14.5 ft in diameter.

Tunnel terminates in a plate-steel-lined reinforced-concrete-incased wye with a 14½-ft inlet and one 10-ft and one 11.5-ft outlet. The wye's plate-steel inlet extends 100 ft upstream into the tunnel and is concrete sealed in the rock. The 10-ft branch of the wye connects through a 10-ft butterfly valve to the manifold, to which the lower halves of the penstocks for the old units are connected, Fig. 3C. The 11.5-ft branch leads to another 10-ft butterfly valve attached to the new unit. This arrangement insures operation of either section of the plant even though one may be shut down for servicing.

Equipment. The new La Grande turbine built by Pelton Water Wheel Co has 55,000-hp rating at 257 rpm under a 416- to 378-ft head. A relief or pressure-regulating valve for 100% turbine discharge, 1410 cfs, branches from the scroll case and discharges into an energy absorber. This valve directly connects by mechanical linkage to the turbine wicket-gate shifting ring to insure positive valve opening should the governor close the gates quickly, as on sudden loss of load.

The machines in the two sections of La Grande plant, Fig. 5, form an interesting comparison of 35 years of water-power development. There are four main horizontal-shaft units in the

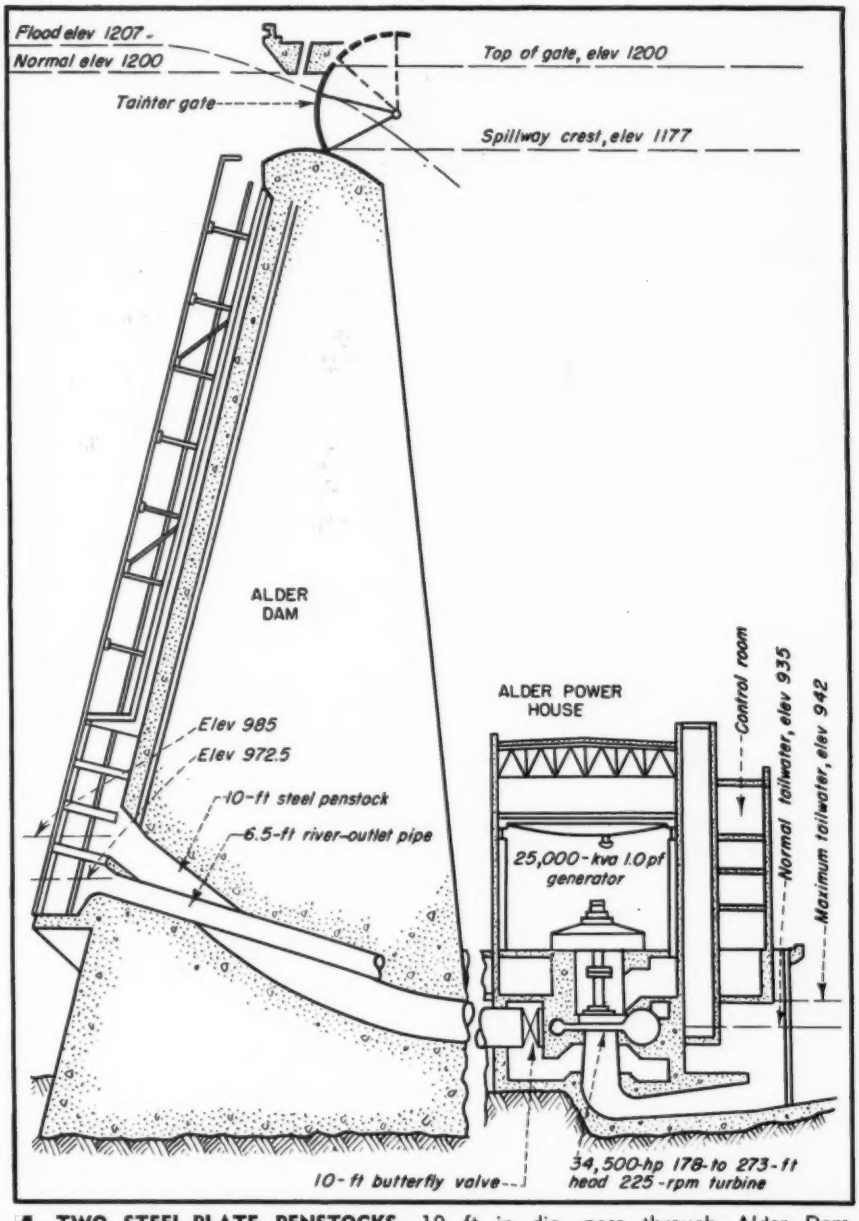
old section. Each consists of an Allis-Chalmers 8000-hp 450-rpm inward-flow reaction turbine with cast-steel scroll case, and direct-connected to a 6000-kva 6600-v generator of the same make. There are also two 200-kw 125-v exciters driven by 375-hp Pelton impulse wheels. The powerhouse, 150 ft long by 50 ft wide, provides 7500 sq ft of floor area compared to the new section, 80 ft long by 72 ft wide, or 5760 sq ft floor area for 70% more capacity.

Generators, Transformers. At Alder plant, Fig. 6, generators are General Electric, rated 25,000 kva, 1.00 pf, 13,800 v, 60 cycles, and at La Grande plant 40,000 kva. Each generator connects solidly to its bank of 13,800- to 110,000-v watercooled transformers, with the exception of a disconnect that can be opened only under no voltage. Generator and its bank of transformers, therefore, act as a unit. That is, when a generator is out of service its transformers are also. Modern generators and transformers fail so seldom it is economical and good practice to group them as units. Fig. 7 is a single-line diagram of generator and transformer connections at Alder plant.

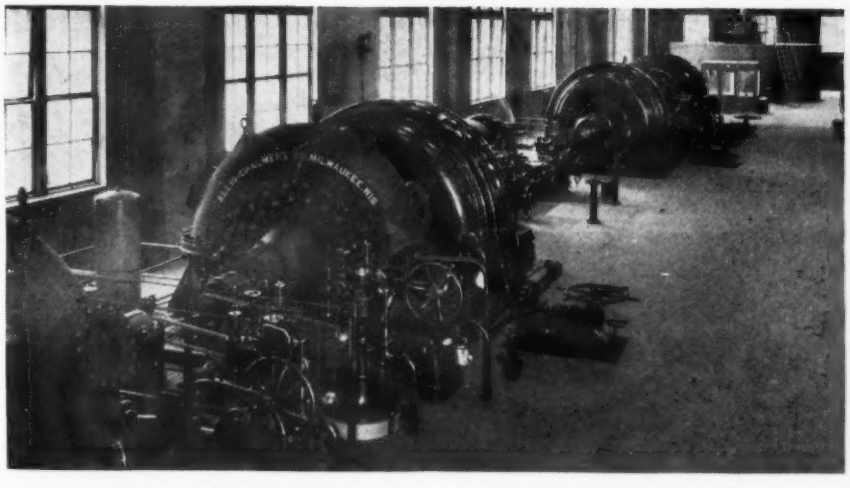
This arrangement has several advantages: (1) It reduces length and size of generator connections because transformers can be located near their generators. (2) Short-circuit current on low-voltage side of transformers is limited to that from one generator. (3) Transformer banks can have smaller capacity. (4) Magnetizing inrush current cannot affect differential protection because voltage on transformers increases gradually as generator speed and field current increase. (5) Eliminates generator breakers and busbars.

Isolated-phase 13,800-v generator connections are metal-enclosed bus structures designed to reduce faults to single phase to ground. Generators and transformers have differential-relay protection against phase faults and voltage-relay protection for ground faults on the generators. Generator neutrals are connected to ground through potential transformers only, Fig. 7.

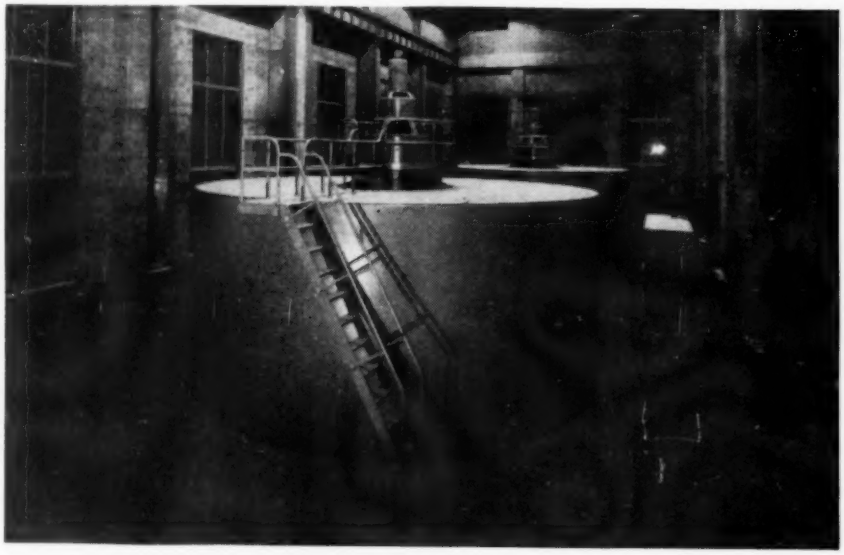
Primary-winding impedance of these transformers limits to a low value the ground current that can flow. Therefore, with the generator leads insulated, if a ground occurs in the generator windings it does not cause serious damage. The neutral potential transformer operates a voltage relay and annunciator to let the operator know of the ground fault in the machine. Knowing that nothing serious can happen if the generator continues in operation a few



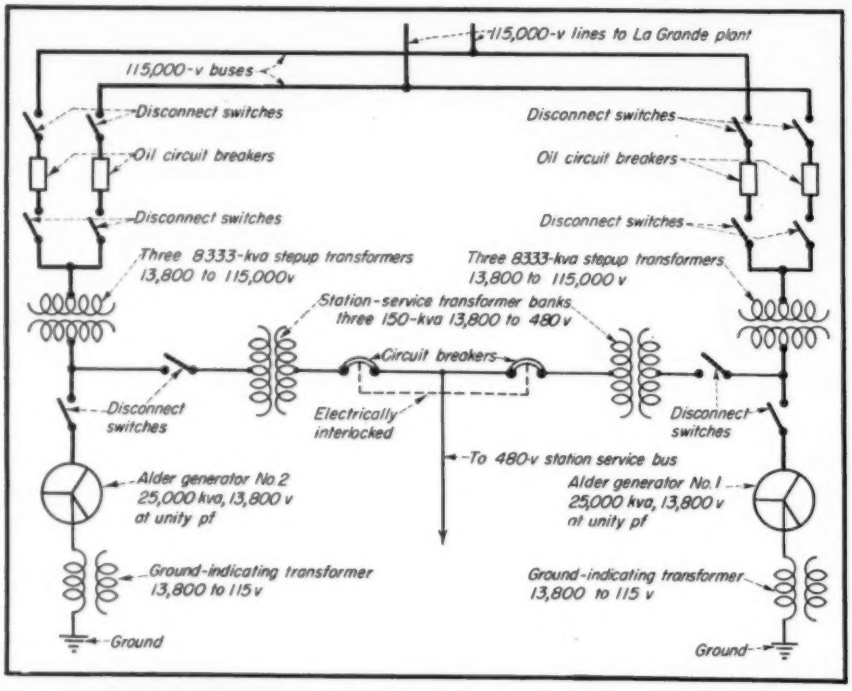
4 **TWO STEEL-PLATE PENSTOCKS,** 10 ft in dia, pass through Alder Dam, connect to two 34,500-hp francis vertical-shaft turbines for 178- to 273-ft head



5 **LA GRANDE POWERHOUSE** with old horizontal-shaft 8000-hp 450-rpm units in the foreground, and new vertical-shaft 55,000-hp 257-rpm unit in the rear



6 **ALDER GENERATORS** rated 25,000 kva at unity pf, 13,800 v. Generator windings Y-connected, neutral grounded through a potential transformer


115,000-v lines to La Grande plant
115,000-v buses
Disconnect switches
Oil circuit breakers
Disconnect switches
Three 8333-kva stepup transformers 13,800 to 115,000v
Station-service transformer banks three 150-kva 13,800 to 480 v
Circuit breakers
Disconnect switches
Electrically interlocked
To 480-v station service bus
Alder generator No 2 25,000 kva, 13,800 v at unity pf
Ground-indicating transformer 13,800 to 115 v
Ground
Disconnect switches
Oil circuit breakers
Disconnect switches
Three 8333-kva stepup transformers 13,800 to 115,000 v
Disconnect switches
Alder generator No 1 25,000 kva, 13,800 v at unity pf
Ground-indicating transformer 13,800 to 115 v
Ground

7 **SINGLE-LINE DIAGRAM** of Alder generators, transformers. Generators connect direct to stepup transformers without breakers and operate as a unit

minutes the operator starts and puts another machine in service to replace the faulty one before taking it off the line.

Alder Service. At Alder plant, station service is provided by a bank of three 150-kva 13,800- to 480-v transformers connected through a metalclad bus to each 25,000-kva generator, Fig. 7. Either bank will carry the station load and the 480-v circuit breakers are electrically interlocked so only one transformer bank can be connected to the station service bus at one time.

A 6900-v line from La Grande, which connects through transformers to the Alder 480-v bus, provides a third source of station service. This allows transferring load from one generator to the other without paralleling them at 480 v. The generator service circuit breakers are interlocked to prevent paralleling. Service transformers are noninflammable-liquid filled, making fireproof vaults for them unnecessary.

Control room in Alder plant is on the 5th floor of the building bay, Fig. 4. Control-board panels are all vertical; it is possible to avoid using a bench board because all switching is done on the high-voltage side of the step-up transformers. Use of 4¼-in. 240-deg instruments also aided in using small panels. Because of their long scales these instruments can be read as easily as standard designs. After nearly two years' experience with them the operators are highly satisfied.

La Grande Setup. The new La Grande installation is in general similar to Alder. Any essential difference was caused by the old installation. Originally the four old generators connected through oil circuit breakers to a bus. Two banks of 6900- to 50,000-v transformers connected this bus to a 50,000-v line. Oil circuit breakers and disconnect switches were provided on each side of the transformers.

The 6900-v circuit breakers were replaced recently with new ones suitable for the enlarged system. Transformers were modernized and their high-voltage windings arranged for operation at either 50,000 or 115,000 v. All this equipment was retained and the high-voltage side of the transformers reconnected for 115,000 v. The two banks were paralleled through disconnect switches and from there on, the old station was treated as a single unit.

A new 115,000-v switchyard, duplicating that at Alder, was built in the abandoned equalizing reservoir at the top of the cliff. Two circuits, one from the four old units and one from the new machine, were brought into this yard from the powerhouse. The other side of the yard tapped into the 110,000-v line from Alder to Tacoma.

One bank of station-service transformers is connected to the new unit by metalclad bus similar to that at Alder. The other bank connects to the 6900-v bus for the old units. Secondaries of both banks parallel in a cabinet-type station-service switching unit.

With one development, Nisqually No. 2 in the Cascade Mountains, southeast of the city, and another, Cushman plants No. 1 and 2, in the Olympics west of the city, Tacoma's Department of Public Utilities can take full advantage of stream-flow diversity in the two watersheds to increase operating reliability and efficiency.

POWER is indebted to C A Erdahl, commissioner, City of Tacoma, Department of Public Utilities, for permission to write this article, and, for assistance in writing it, to J Frank Ward, superintendent of the Light Division, and his engineering associates. Verne Gongwer was chief engineer of construction during building of the dams and plants.

SOOT ACCUMULATIONS built up around air-heater tubes expose surface to corrosion notably with coals over 2% sulphur

SLAG DEPOSITS of fused or "bird nesting" type are flyash only and occur on tubes close to the combustion chamber

What Causes Slag to Build Up?

Troubles and outages from slag deposits on external boiler heating surface led to a study in England[1] of their nature. They are broken down into three types: fused, bonded and phosphate. Here are descriptions of where and how they form

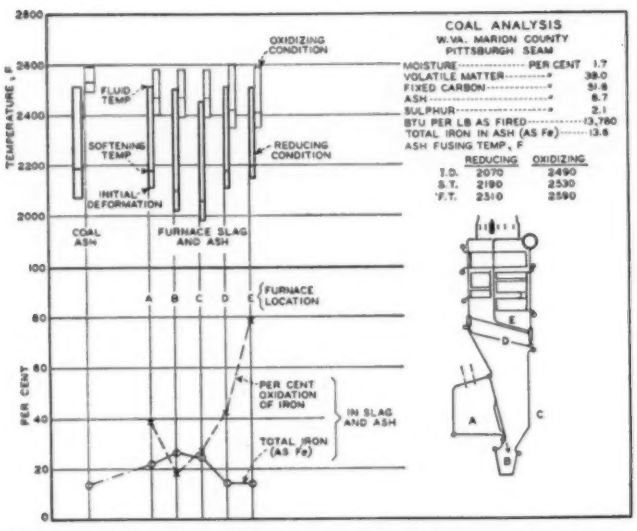
▶ SLAG ON external heating surfaces of boilers can reduce steaming capacity and shorten operating time. These deposits hit at three spots in the steam-generation cycle: (1) boiler and superheater tubes (2) economizer tubes (3) air-heater surfaces. Slag formation, cause and cure differ with fuels and firing methods.

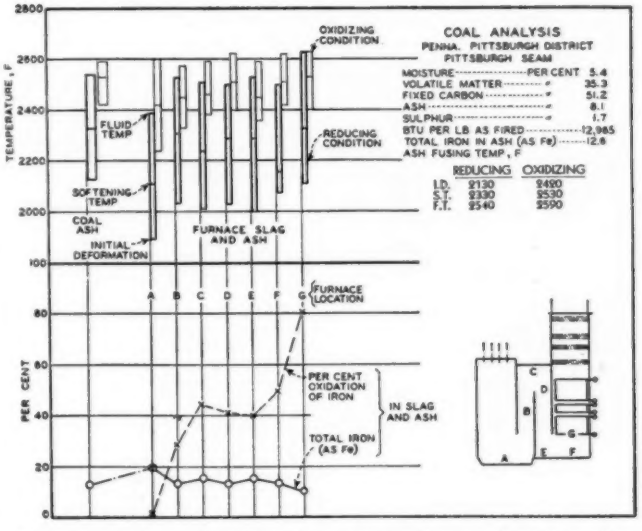
High-temperature deposits — those that form on boiler and superheater tubes—fall into three distinct groups, called fused, bonded and phosphatic.

Fused deposits consist of flyash only. They are the sintered or fused aggregates of what ordinarily would be a loose powder. The fusing process occurs in the combustion zone. If furnace temperatures run high, flyash carries through to deposition on boiler or superheater tubes while it is still in the plastic form. Occasionally it solidifies before deposition. But when temperatures of the leaving gas or the fuel bed go up with increased load a second fusing takes place. "Bird nesting" is usually a deposit of the fused type.

Bonded deposits, commonest on boiler and superheater tubes, are particles of flyash dispersed in a matrix. The matrix is composed mainly of alkali salts—the sulphates and acid sulphates of sodium and potassium volatilized from

[1] "Deposits on the External Heating Surfaces of Boiler Systems," by H E Crossley, Fuel Research Station, before the World Power Conference, Fuel Economy Section C2. Paper No. 3, The Hague, 1947.





SLAG CHARACTERISTICS differ with fuels and firing methods. Above charts as developed from studies by Bailey and Ely[2] show characteristics also change from place to place within boiler and differ again with changes in boiler design

the fuel bed. Anywhere from 10 to 50% is water soluble as contrasted to the almost insoluble fused deposits.

Phosphatic deposits, the last of the group of high-temperature formations, result from the action of flyash on phosphorous compounds volatilized from burning fuels.

Preliminary stage of most bonded and phosphatic deposits is usually a white or light-colored scale that settles on tube surfaces. It is richer in alkali salts than the later, outer layers and has a lower melting point.

Cause of Bonding. Potassium and sodium salts act as binding agents in bonded deposits. They appear in British coals as (1) relatively nonvolatile silicates (2) easily volatilized chlorides. For this reason the Boiler Availability Committee, under whose direction these studies were made, decided to establish a relationship between chlorine content of coals burned and severity of trouble from bonded deposits.

Large-scale trials with a test boiler firing coal of 0.04% chlorine showed an accelerated deposit rate of the bonded type when chlorine content was increased to 0.25% by adding sodium chloride. When 86 British power stations were investigated they showed a further interesting condition. Pulverized-coal fired boilers were relatively free from this trouble. A possible explanation is that the greater amount of flyash with pulverized coal is too much to be bonded by the limited amount of alkali salts in the available time.

Deposit Material. So much for the presence of potassium and sodium in binding agents. What about sulphates?

Most deposits on boiler and superheater tubes have a white, inner layer next to the metal. The character of this layer is important for it decides (1) how firmly deposit attaches to metal (2) how quickly it grows with addition of flyash.

Tests were run to determine influences on the character of this inner layer. A sample of a typical bonded deposit was powdered and introduced to the aerated flame of coal gas and its combustion products. A white alkali of sulphates formed on the metal. Wiping removed it.

Just adding sulphur dioxide to the coal gas changed the picture entirely. The white deposit fused and stuck more closely to the metal. probably because of alkali bisulphates.

The same experiment repeated in a nonaerated flame gave a white deposit. Presence of sulphur dioxide in the flame did not change the character of the deposit. Apparently the acid sulphates had not formed.

A further investigation indicated that sodium and potassium compounds are the offending salts. Chlorides, carbonates and sulphates of these elements gave the same results as the powdered deposit employed in the experiments. Oxides and sulphates of calcium, magnesium, iron and aluminum produced desposits that did not adhere strongly to the metal.

Effect of Temperature. The steel surface, which served for the deposit collection spot in the above experiments, was held at 400-500 C. At 550-600 C the adhesion of deposits containing alkali salts increased. They sintered and developed a sticky outer surface. Such conditions favor deposit growth by addition of flyash.

How do sulphates reach the metal surfaces? Most of the sulphur in flue gas is present as sulphur dioxide, but sulphur trioxide, free or combined with water as sulphuric acid, is the most important of the forms of sulphur as far as deposit formation is concerned. It raises dewpoint of gases considerably, and this facilitates condensation of acid.

H F Johnstone (Univ of Illinois *Bulletin* 228, 1931) believes that sulphur trioxide forms from the decomposition of sulphates in the fuel bed. The Boiler Availability Committee felt experiments to determine sulphur trioxide formation would prove illuminating and helpful.

The Experiments. Introduction of sulphur dioxide to the atmosphere of a flame made up of carbon monoxide and air produced small amounts of sulphur trioxide.

A second series of experiments probed catalytic action of ferric oxide on oxidation of sulphur dioxide to sulphur trioxide. The ferric oxide occurs as a film on steel tubing.

By passing flue gas over steel maintained at various temperatures, different amounts of sulphur trioxide were observed. At some times rusted steel served as the metal, at others steel cleaned by sandblasting. When the steel was heated a film of ferric oxide always formed quickly. Sulphur di-

[2] "Significance of Coal-Ash Fusing Temperature in the Light of Recent Furnace Studies," by E G Bailey and F G Ely, Babcock & Wilcox Co.

RATE OF AIR-HEATER DEPOSITS

Table I—Sulphur Coals on Stokers

Sulphur content	Acute trouble: No. of power stations	Acute trouble: Average run, hours	Minor trouble: No. of power stations	No trouble: No. of power stations
High-medium	9	1380–1610	0	0
High-medium-low	4	2080–2450	6	0
Medium-low	0	*	6	14
Low	0	*	0	8

Table II—Sulphur in Pulverized Coal

Sulphur content	Acute trouble: No. of power stations	Acute trouble: Average run, hours	Minor trouble: No. of power stations	No trouble: No. of power stations
High-medium	0	*	2	0
High-medium-low	0	*	0	0
Medium-low	0	*	1	6
Low	0	*	0	4

*Deposits did not cause shutdown

oxide underwent conversion to sulphur trioxide, most actively at 600 C. (Economizer studies indicate iron sulphates figure in formation of sulphur trioxide and promote sulphatic deposits.)

Control of Sulphur Trioxide. Deposits increase with the presence of sulphur trioxide in flue gas. Control of deposits can come from (1) reducing sulphur trioxide in the gas (2) overcoming the influence trioxide has on dew-point.

A study of the combustion process revealed little deposit accumulation on metal until all the volatile content of the coal had been liberated. Rate of deposit growth increased considerably as coke burned to ash. Further, the deposit adhered more strongly.

Boiler trials with traveling grates showed fuel-bed conditions influence rate of deposit growth. With isolated areas of combustion continuing to the back end of the grate, deposits formed rapidly. A regulated combustion, with the fire ending evenly across the grate width and before the full travel of the grate, gave much less formation.

Further trials revealed that increasing the volatile content of fuel decreased troubles from deposits. For test conditions oil burners supplied liquid-fuel in addition to the normal coal supply of a traveling-grate furnace. Similar trials are reported under way with pulverized coal as auxiliary fuel.

Soot Removers. Next point of control — overcoming influences on dew-point—resulted in a satisfactory experience with "smokes." These smokes introduced in flue gas lowered the dew-point—at times to that of gas free from acid. Several substances supplied this "smoke," carbon, silica. magnesia and zinc oxide serving in this way. The lowering effect has been attributed partly to absorption of sulphur trioxide on the very large surface of the dispersed solid.

The next constituent of deposits to receive committee study was silica. In British coals this appears as aluminum silicates. Any of this substance carried mechanically from fuel bed to heating surface adds alumina as well as silica to the external deposits on heating surfaces. Some deposits showed no alumina at all. The inference, then, was that somehow silicon volatilizes in the fuel bed.

German engineers follow the theory advanced by R Lessnig[3] that silicon sulphides form in the boiler under the action of carbonaceous matter and iron sulphide on silicate. For this reason they exercise every care in limiting the amount of hydrocarbons in flue gas. They believe these substances act as reducing agents for forming silicon sulphides.

W Lange[4] has pointed out that silicon sulphides burn in air to form silica. Later developments show reduction of sulphides by hydrocarbons occur only on suspended particles containing both iron sulphide and silica. Sulphide in flyash amounts to little. Further, iron sulphide oxidizes in passing through the combustion chamber.

All these facts point up the findings of the Boiler Availability Committee and put the German practice of reducing hydrocarbons at variance with the evidence. The Committee believes increasing the hydrocarbons in flue gas decreases trouble from deposits. This was done in one case, cited above, by adding liquid fuel burners to a boiler that normally burned coal on a traveling grate.

Phosphatic Deposits. This class of deposit forms when phosphorous compounds volatilize. A special gas-fired furnace held at 1200 to 1700 C. served as the test medium for volatilization of phosphate. Reducing conditions accompanied by high temperatures produced this volatilization effect.

Phosphatic deposits have been found only in stoker-fired boilers employing coals of over 0.03% phosphorous. Pulverized-coal units carry out combustion under oxidizing furnace conditions so no phosphatic deposits occur. Traveling-grate stokers do volatilize phosphates but at a very slow rate.

Retort stokers develop reducing conditions, and phosphatic deposits seem prone to develop in this atmosphere. Waterwall cooling of the furnace however, may reduce furnace temperatures enough to make volatilization slow.

Suitable methods of cleaning represent the most important factor in operating boilers to peak availability. This rule of suitable cleaning applies to boilers both in and out of service. Deposits form slowly at first but once there, the rate of additional deposit growth increases rapidly.

Soot blowing and water lancing offer the best, practical cleaning methods for boilers under load.

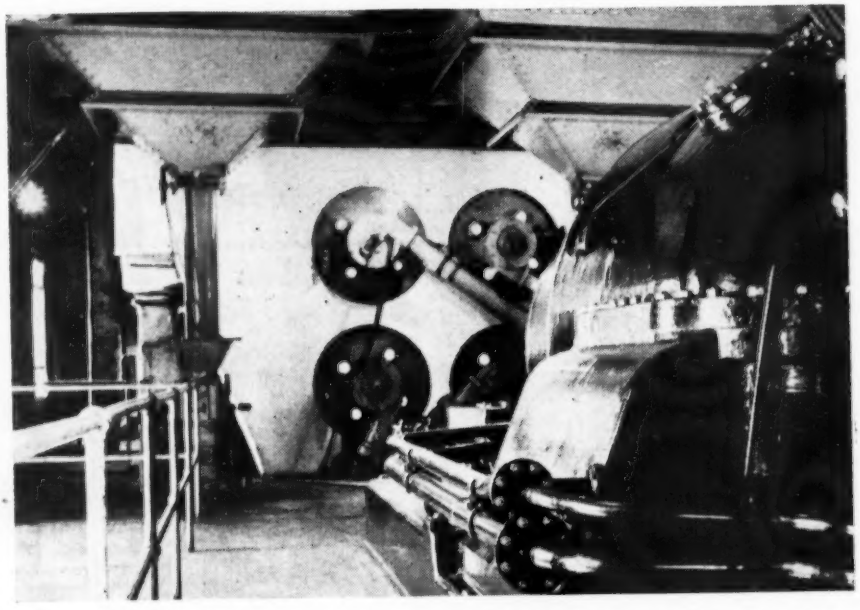
The practice of hand-cleaning an out-of-service boiler leaves a skin of deposit. Once removed, this skin takes several hundred hours to reform. "Steamsoaking"—subjecting the heating surfaces to the action of saturated steam — removes this skin deposit. There are cases where better cleaning methods have lengthened boiler runs from under 1000 hr to 5000 hr.

Carrying a boiler on the line until deposit growth forces a shutdown is poor operation. Boiler-efficiency loss, while serious, represents only a fraction of the loss imposed by added hours required to remove the added deposit.

Where practicable reserve for pulverized firing any coals of over 1.8% sulphur, 0.03% chlorine, 0.03% phosphorous. Beyond this general rule no proved steps seem possible with stoker-fired units to alleviate deposit growth. A study of inorganic "smokes" is under way to determine the extent of help that can come from this source.

[3] Feuerungstech, 1940, 28, 145.
[4] Gluckauf, 1940, 76, 410.

Ten Years' Experience Burning



COAL BURNERS: Windbox and pulverized-coal burners of No. 3 boiler are in center background with No. 4 turbine on right. No wall divides boiler and turbine rooms

Our plant normally burns lignite and subbituminous with high-ash, high-moisture content, but to lick a fuel shortage and high prices we bought a huge culm dump. This coal, with 36.2% ash and 6600 Btu, is pulverized and burned under our boilers

By A R EASTCOTT, *Power Plant Superintendent*
Granby Consolidated Mining, Smelting & Power Co.

▶ TO SUPPLY STEAM AND POWER where they are needed, a plant engineer has to figure out many answers. Here's how we did just that for ten years at the 17,500-kw steam-electric plant of the Granby Consolidated Mining, Smelting & Power Co, Ltd. This plant, which serves the company's copper mine at Copper Mountain and its concentrator at Allenby, is on the Similkameen River near Princeton in southern British Columbia, about 200 miles east of Vancouver.

Main Equipment. The three boilers in the plant are:

One 40,000-lb-per-hr chain-grate stoker-fired Stirling boiler.

Two 80,000-lb-per-hr Combustion Engineering boilers, pulverized-coal-fired as follows:

No. 2. by two Raymond impact mills

No. 3 by two Raymond bowl mills.

In the power-generating plant are four steam turbine-generators:

No. 1: 500-kw Allis-Chalmers

No. 2: 2000-kw Frazer-Chalmers

No. 3 and 4: 5000-kw and 10,000-kw Allis-Chalmers.

Steam conditions are 250 psi, superheated to 600 F. All boilers are equipped with forced- and induced-draft fans, and Bailey manually operated combustion control. Feed pumps are turbine-driven 2-stage centrifugals. Three circulating pumps, of 10,000-gpm capacity each, provide cooling water for the condensers, one being enough in winter and two in July and August. One service and two fire pumps supply water to service and fire lines. All pumps are motor driven, installed in a pumphouse near the intake pond on the river bank.

Local Coal Supply. When erected in 1937, the plant contained No. 1 and 2 boilers, and No. 1, 2 and 3 turbines. Coal in the area is lignite and subbituminous, of high ash and moisture content and 7300 to 9000 Btu per lb.

Experience with the original two pulverized-coal-fired boilers taught that the coal's high inherent moisture required more drying than the plate-type preheater provided. A tubular primary air heater was subsequently installed in the second pass of No. 2 boiler to supply high-temperature air to its impact mills.

From 1937 to 1940, we purchased some power from the public utility serving the district. In 1940, we expanded the plant by adding No. 3 boiler and No. 4 turbine. This boiler is a Combustion Engineering VU type of 80,000-lb-per-hr steaming capacity, similar to No. 2; the turbine is a 10,000-kw Allis-Chalmers unit.

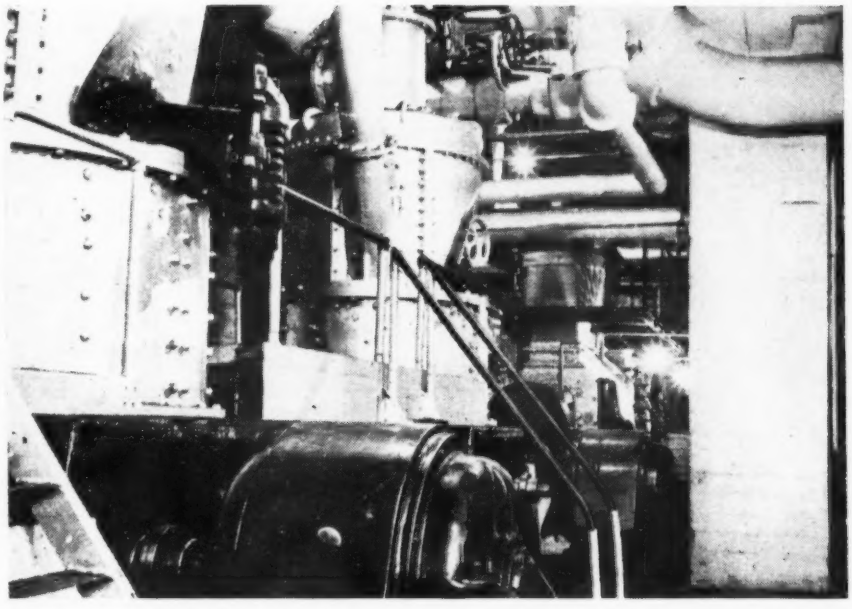
Experience with the high-moisture lignite dictated a high mill temperature. Therefore, the new boiler was equipped with a tubular heater for primary air in its first pass in addition to the plate preheater at the boiler outlet. Combustion-air temperature is raised to 375 F in the plate preheater, which is adequate for secondary air. Primary air from this source is raised in the tubular heater to 600 F; at this temperature it goes to the pulverizing mills.

Two 4.8-ton-per-hr Raymond bowl mills fire the new boiler. These are larger than bituminous coals require, but poor grindability and high ash and moisture content of local coals dictated ample mill capacity.

Experience at Granby has proved that subbituminous and lignite coals can be burned successfully in suspension by either the bowl- or impact-mill pulverizer. But ample mill capacity is required along with a primary air heater to supply 600-F air to the mill inlets. In spite of this coal's poor grindability mill wear need not be excessive. Because of high volatiles and low fixed carbon this coal is readily ignited; therefore, it is not necessary to pay too much attention to fineness.

We obtain a somewhat higher efficiency from No. 3 boiler, equipped with bowl mills, than from No. 2,

Lignite and Discarded Slack Coal



PULVERIZING MILLS: Coal-pulverizing mills that use 600-F primary air are in basement below burners. Bowl mills in foreground; impact mills in right background

which has impact mills. At first we attributed this difference to the mills, but experience over a number of years leads to the conclusion that for this class of fuel one mill has practically no advantage over the other.

No. 3 boiler, with four burners instead of two, with a better primary air heater, and a variable-speed hydraulic coupling on the induced-draft fan, can be expected to show a slightly higher efficiency than No. 2. If No. 2 had four burners and impact mills of a larger size, we believe the difference in the two boilers' efficiency would be negligible.

Where bituminous coals are burned, fineness remains constant over a longer period in a bowl mill, with one adjustment of the classifiers, than in an impact mill. This is an advantage for the bowl mill. but with high-volatile low-fixed-carbon coals, fineness is not of paramount importance. On the other hand, impact mills have the advantage of simpler construction. Our experience has been that outages for an impact mill are more frequent, but of shorter duration than for a bowl mill.

When burning pulverized coal the operating staff keeps an accurate log of hours' operation and tonnage through the pulverizers. Without such records, repairs could not be scheduled intelligently. We completely overhaul the bowl mills every 10,000 hr of operation or every 22,000 tons of coal, whichever comes sooner. This overhaul includes new liners, bull rings and grinding rolls. The impact mills do not have as definite overhaul periods. The hammers are turned at 1200 to 1500 tons, and renewed at 2300 to 2500 tons. At each hammer renewal, liners are inspected and renewed where necessary.

Coal Handling. Coal supplied by truck from local mines and by rail from outside is delivered by elevator and screw conveyor to the boiler bunkers. Under normal load conditions from 185 to 200 tons are burned daily. From 15,000 to 20,000 tons are usually stored in the yard adjacent to the plant. This coal is handled by dragline scraper. We have had some trouble with spontaneous combustion in the stockpile. Certain local coals cannot be stored deeper than 6 ft. Others give no trouble when properly spread and compacted by a bulldozer, even when piled to a depth of 15 to 20 ft. When coarse and fines segregate in the stockpile, spontaneous combustion invariably follows.

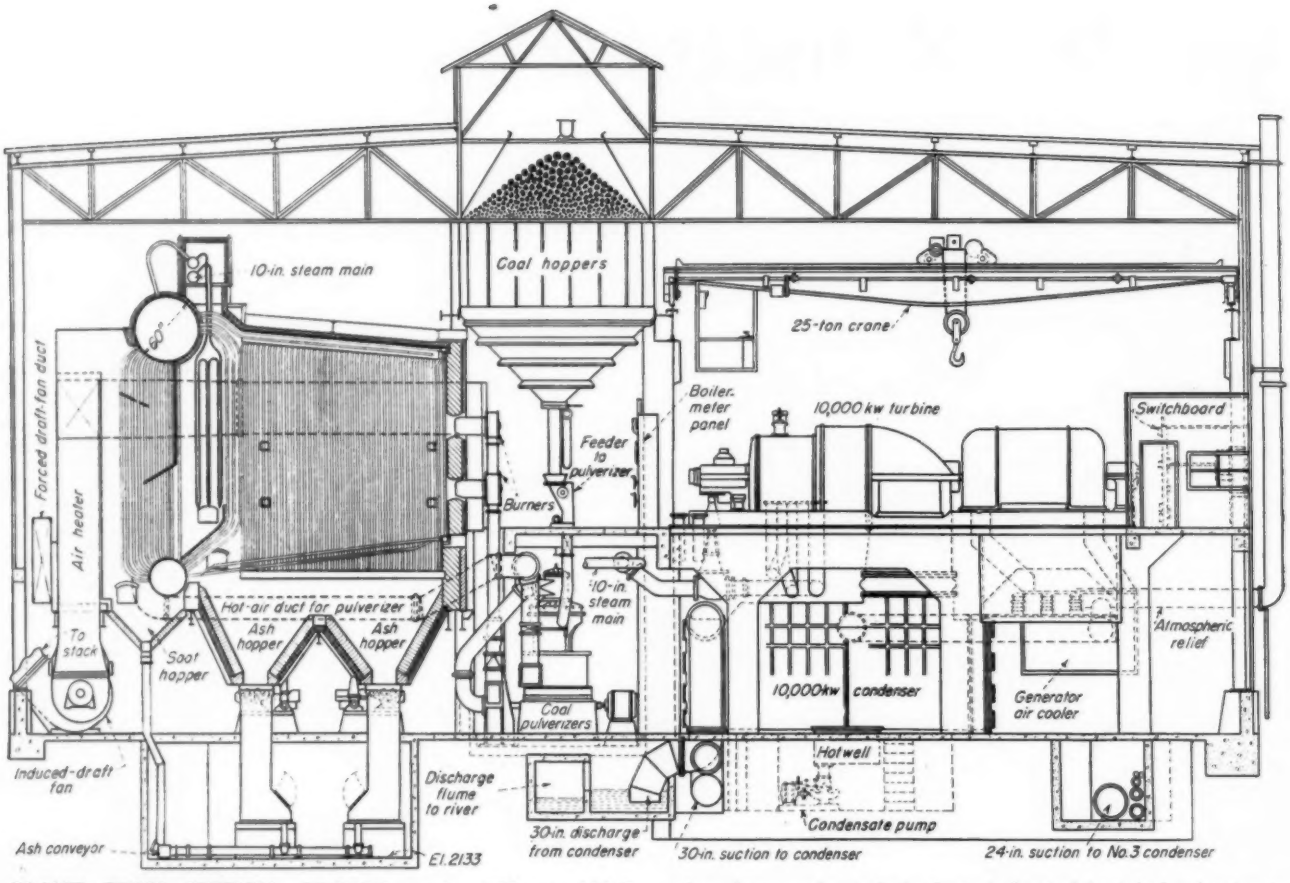
As originally built the boilers were not equipped with flyash precipitators. We soon found, however, that we had to reduce the flyash nuisance. Space limitations precluded installing standard precipitators ahead of the induced-draft fans, a problem solved by installing water-spray gas scrubbers between fans and stacks. Discharge from the scrubbers is pumped to a series of settling ponds from which nothing but clear water returns to the river. The pulverized-coal-fired boiler furnaces have hopper bottoms, as in cross section, p 78, to take care of the large quantity of ashes, which are removed to a hopper outside the plant from which they are trucked away.

Operating straight condensing with no process-steam requirements, the plant has no serious feedwater problems. raw makeup water being only about 3% of total evaporation. The Hall system of internal treatment is adequate. Boiler water is tested daily for phosphate, alkalinity, sulphite and sulphate. An excess of phosphate is maintained to combat calcium carbonate hardness and to prevent precipitation of sulphates. An excess of sulphite is maintained to scavenge oxygen from the water. Caustic soda controls desired alkalinity. We use dispersive tannin as an embrittlement inhibitor and as a mechanical means of preventing scale. Amount of blowdown is determined by the sulphate reading.

No. 2 and 3 boilers are taken out of service every four months for washing. On the first outage of the year, drum internals are removed to turbine first-pass and roof tubes. On the second outage, waterwall tubes are turbined, and on the third outage, floor tubes. Thus, every tube in contact with radiant heat is turbined once a year. The downcomers in the rear pass are never turbined because washing them at each washout period is sufficient. During each outage the induced-draft fan and other auxiliaries are inspected and repaired.

Boiler Plant Operation. The table gives a fair picture of the boiler availability, steam production and tons of coal burned by each boiler during the 10-year period, 1937-46. No. 1 boiler has become a standby since No. 3 was installed. Its long outage in 1943 was due to renewal of the mud drum.

In the boiler plant's operation we have had to iron out the usual bugs. Slagging of the first-pass tubes was one of our most serious difficulties. Some improvement resulted from lowering the first-pass baffle to reduce gas ve-



PLANT CROSS SECTION: 80,000-lb-per-hr 250-psi 600-F boiler has air heater for 375-F combustion air. Primary air, taken from preheated-air duct, is heated in tubular heater to 600-F. At this temperature it goes to the coal-pulverizing mills

locity in this pass. We find 4-hour soot blowing necessary. When burning some coals, the first-pass tubes require hand lancing also. On the pulverized-coal-fired boilers, adjusting the secondary-air dampers in the burners to reduce flame length also reduces slagging on the slag-screen tubes. This operation is quite restricted.

As mentioned, from 1937 to 1940 power was purchased from the utility serving the district. But since the plant expansion in 1940, the utility, pressed by wartime demands, has frequently purchased power from the Granby Co. An interesting fact is that power purchased from the utility, 14,000,000 kwhr, is almost equal to power sold to it. Therefore, Granby steam plant and the utility hydro plant are of mutual benefit.

Even though we are doing a pretty good job with what we have, the efficiency of Granby plant cannot compare with that of a modern utility steam plant. The second-hand turbines limit steam conditions to 250 psi, superheated to 600 F. Moreover, when the plant was first built cheap coal was readily available at the company's own mine. Therefore, investment for automatic combustion control, CO_2 recorders and similar equipment was not warranted. Since then, rising coal prices have altered the picture and the time is at hand when installation of some of this equipment can be justified.

Slack Dump. In 1944, faced with coal scarcity and high prices, a huge dump of discarded slack, some of it over 30 years old, was purchased at an abandoned mine 10 miles from the plant. Installing a Bradford breaker and suitable conveyors to load rail cars makes it possible to reclaim this waste dump by bulldozer, at the rate of about 20,000 tons a year. Because of snow conditions, reclamation can be carried out only in summer. Coal not immediately burned is stockpiled in the yard adjacent to the power plant. Some analyze moisture 7.66%; ash 36.20%; Btu 6600 as received and 7150 dry. We have displayed a lot of ingenuity at Granby, getting steam out of coal that, according to the experts, could not be burned.

Since evaporation per lb of coal means little without the calorific value of the fuel, coal-testing apparatus was added to the mine concentrator assay office at Allenby in 1942. Since then the firemen have taken hourly samples from the coal feeders, which are subsequently made up into composite daily samples for the assay office. Proximate analysis is made daily and reports returned to the plant.

Operation during 1942 set a record for the plant, because it was the first year we had a complete coal-analysis record: we burned 84,110 tons of 8303-Btu coal, generated 70,690,280 kwhr at an over-all heat rate of 19,761-Btu per kwhr. Next year the heat rate dropped to 18,217-Btu per kwhr, which is the lowest in the plant's history. From 1943 to 1945, plant output was below normal because of wartime labor shortage at the mine, resulting in reduced ore output. Power-plant output, in 1946 dropped to 28,200,000 kwhr because of a lengthy hardrock-miners strike, but in 1947 it returned to normal with 70,000,000-kwhr generation.

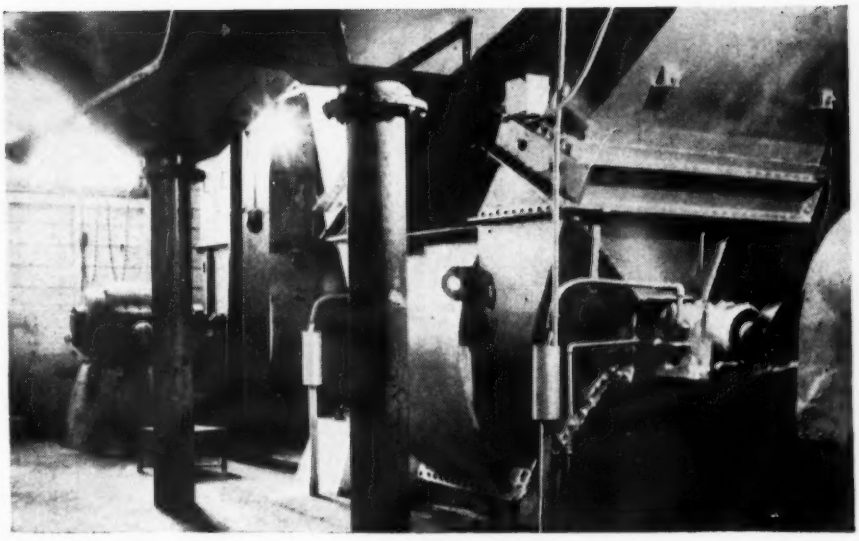
Turbines. We have had the usual difficulties operating our turbines. During its first year's service No. 3 had to be rebladed. No. 1, 3 and 4 have been rebalanced at different times. The field

of No. 2 grounded in 1943 and 1946. Both times repairs were made locally. Outside of these accidents, most turbine outages were due to condenser cleaning. The 5000- and 10,000-kw units are equipped with totally enclosed generator air coolers, and some outages have been due to broken tubes in the air coolers. In spite of these difficulties, 5000- and 10,000-kw turbines have an average availability factor of 93.7 and 95.7% during their nine and seven years' operation, respectively.

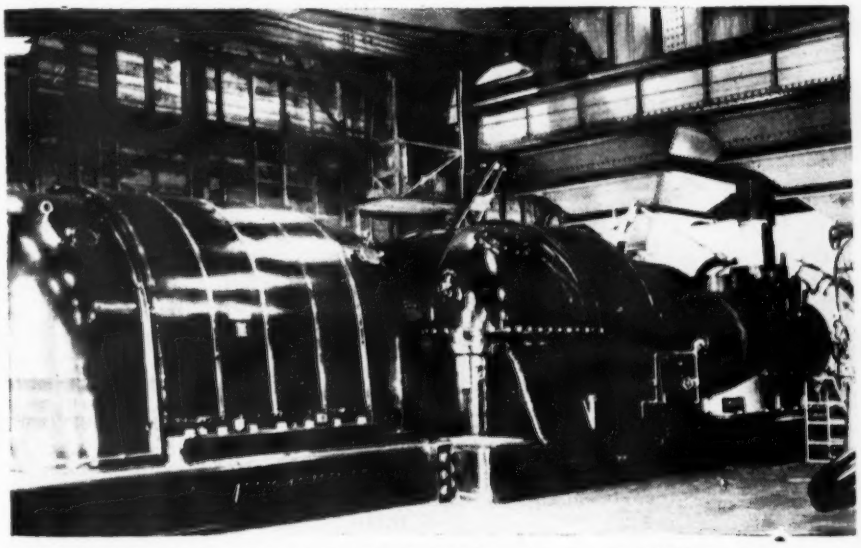
Turbine-blade fouling has never been a problem. This may be a tribute to our feedwater treatment, which we follow religiously, and to the efficient operation of drum internals in boilers No. 2 and 3. The 10,000-kw turbine is opened once every two years for inspection.

The operating staff consists of one engineer, one fireman, one oiler and one coal operator per shift who, in addition to their other duties, maintain an accurate log of hourly meter readings. These, together with meter charts, are kept on file in the plant offices for ready reference.

Power-plant construction began on January 15, 1937, when the temperature was 30 F below zero. The first turbine started March 23, the second during the first week in April, and the third July 1, 1937. They took full load on August 14, seven months after construction started. A C R Yuill of Vancouver was consulting engineer on plant construction and J Southin was the first superintendent. The writer is indebted to the management of the Granby Consolidated Mining, Smelting & Power Co and to A C R Yuill for much of the early history of the construction, operation and other features of the plant.



BOILER FANS: Forced- and induced-draft fans are on the boiler-plant basement floor. F-d fan discharges through the air preheater and the i-d fan to the stack



TURBINE ROOM: Largest unit in the 17,500-kw plant, a 10,000-kw turbine, is in foreground with electric crane at upper center and boiler coal bunkers at right

BOILER AVAILABILITY, STEAM PRODUCED, TONS OF COAL BURNED, AND EVAPORATION

Ten-Year Period, 1937 to 1946

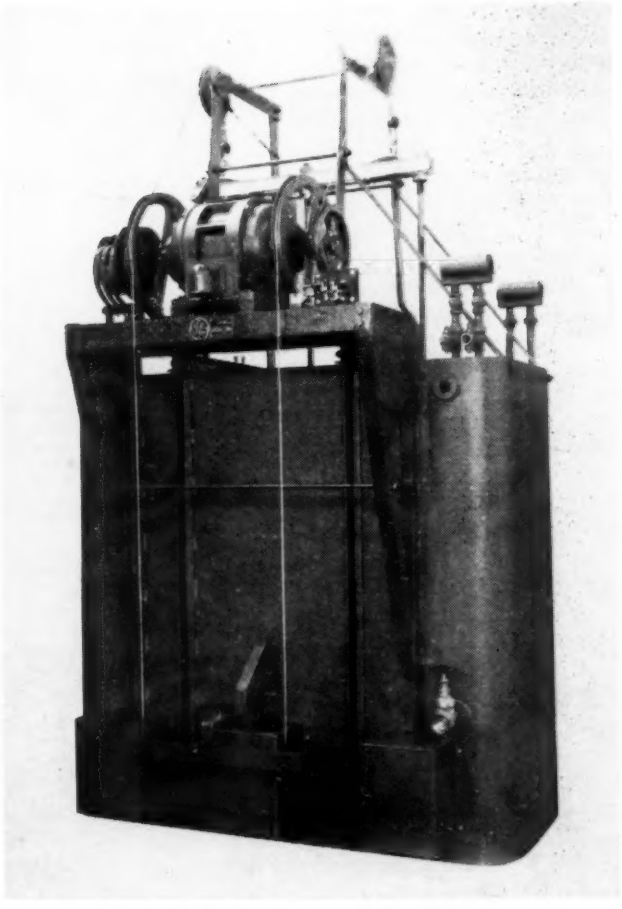
	No. 1 boiler: 40,000 lb per hr — Chain-grate-stoker fired				*No. 2 boiler: 80,000 lb per hr — Pulverized-coal fired*				*No. 3 boiler: 80,000 lb per hr — Pulverized-coal fired*			
Year	*Availability, %*	*Steam produced, 1000 lb*	*Coal burned, tons*	*Evap, per lb coal*	*Availability, %*	*Steam produced, 1000 lb*	*Coal burned, tons*	*Evap, per lb coal*	*Availability, %*	*Steam produced, 1000 lb*	*Coal burned, tons*	*Evap, per lb coal*
1937.....	95.8	151,455	16,784	4.04	55.8	145,585	9,266	7.00	....	.....	.....	....
1938.....	95.6	228,240	24,580	4.50	95.6	575,987	45,686	6.00	....	.....	.....	....
1939.....	98.0	204,441	23,780	4.26	98.0	625,873	59,420	5.30	....	.....	.....	....
1940.....	87.8	213,034	24,200	4.40	87.8	579,124	54,203	5.33	37.0	78,290	7,280	5.23
1941.....	91.5	27,014	3,625	3.07	85.3	359,823	34,470	5.21	96.7	403,967	36,820	5.51
1942.....	99.7	19,561	2,390	4.09	89.2	310,124	29,090	5.32	97.0	573,922	52,570	5.45
1943.....	47.3	5,540	705	3.87	94.5	226,097	21,385	5.32	97.5	508,912	47,440	5.37
1944.....	100.0	8,963	1,200	3.73	97.3	264,150	22,764	5.80	96.1	535,104	36,741	5.92
1945.....	100.0	2,338	439	2.65	98.5	79,643	7,271	5.48	96.4	472,519	38,955	6.06
1946.....	100.0	5,029	855	2.94	97.2	112,228	10,528	5.33	95.2	308,221	26,438	5.85
Totals....	91.6	865,617	98,558	4.38	89.9	3,278,634	294,083	5.57	87.9	2,780,935	246,344	5.65

Note: In 1943, outage of No. 1 boiler was due to replacement of the mud drum.

Liquid Rheostat Gives Smooth Speed Control

Its use assures stepless speed control of wound-rotor motors. Here are design and operating features, as well as advantages over conventional grid rheostat

By G L McFARLAND
Control Engineering Division
General Electric Co



SPEED ADJUSTMENT of 900-hp 2200-v 3-phase wound-rotor induction motor is smoothly handled by this liquid rheostat

▶THE LIQUID RHEOSTAT has come far since the "salt box" design was first used. Modern units have wide application for the acceleration and speed control of polyphase wound-rotor induction motors. These rheostats are notable for their stepless-speed control with minimum maintenance and maximum dependability. Supersonic wind-tunnel drives, centrifugal fan and pump loads, as well as steel-mill roll drives, are among those applications depending upon the liquid rheostat for speed control.

To become familiar with basic construction, we will look into pertinent design features, along with some of the properties of the electrolyte used as the resistance medium.

Rheostat Design. Let's begin with specific details in the design. Basically, the liquid rheostat consists of stationary and movable metal electrodes, which serve to introduce current into the electrolyte. This conductor is merely a mixture of a few percent by weight of sodium carbonate (Na_2CO_3) in clean water.

Resistance (ohms), which the electrolyte offers to the flow of current, is approximately proportional to the distance between electrodes, Fig. 2. If they are fixed at a given gap or spacing, the resistance is fixed for any given electrolyte density and temperature, as shown in Fig. 5.

To vary the resistance, one of the electrodes is moved up or down to change the current-path length in the electrolyte, which is held in a steel tank. The lower or fixed electrode is insulated from the tank. To prevent the electrolyte leaking from the tank, resilient insulating gaskets are used between tank and insulators, Fig. 3.

Operating Principle. Since the resistance is to be changed easily, the movable electrode is connected to an operating mechanism, which may be a pilot motor, torque motor, air cylinder, hydraulic cylinder or manual device.

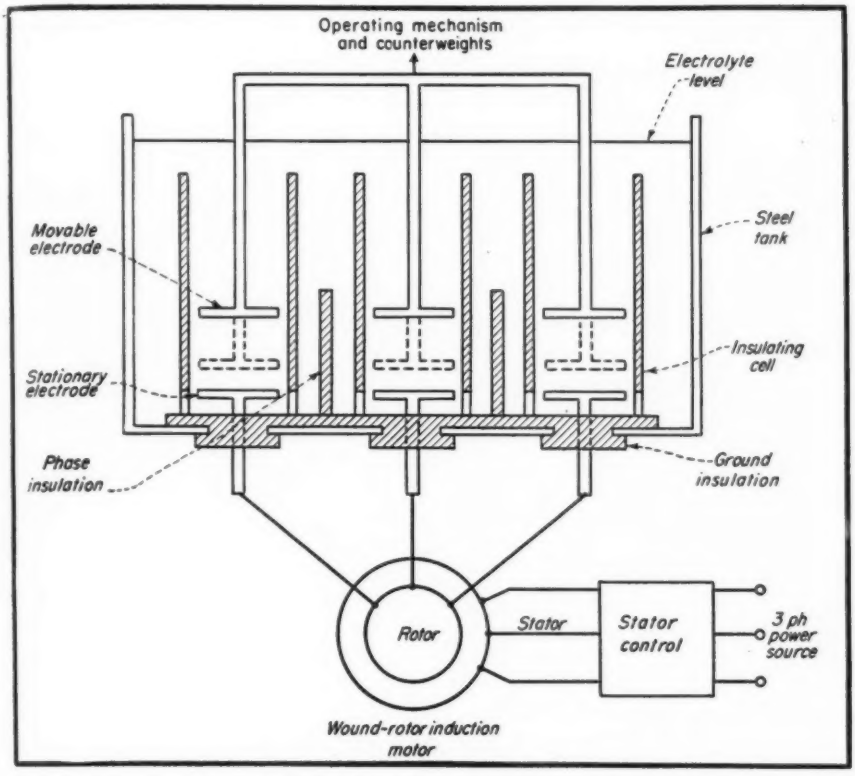
This operating mechanism must lift as well as lower the movable electrodes, which often weigh several hundred pounds. Consequently, these electrodes are partly counterbalanced with weights, Fig. 3. The operating device—hydraulic cylinder, motors or manual means—is therefore reduced to a minimum size and needs only to overcome the friction loads and electrode weight remaining.

To summarize, the basic liquid rheostat consists of fixed and movable electrodes in a steel tank containing the electrolyte, with an operating mechanism at the top to adjust the resistance to the desired value.

Consider the basic unit just described as the variable resistance in each of the lines connected to the rotor circuit of a 3-phase, wound rotor motor. The liquid rheostat for secondary control of three phases can then be considered as an assembly of three of the basic units in a single tank. To provide the Y-connection for the secondary of the wound-rotor motor, the movable electrodes are connected to form this neutral point. The operating mechanism acts directly on the assembly of the three movable electrodes and their shorting busbar.

Advantages. Liquid rheostats have several advantages over other types and combine, in one device, several desirable features.

1. Resistance can be varied smoothly between minimum and maximum values to provide stepless-speed control of the



1 Insulating cell surrounds each electrode preventing current leakage to tank. Heat generated in electrolyte is dissipated in a watercooled heat exchanger

wound-rotor motor, and fine adjustment.

2. The resistance element—electrolyte—which carries the current, absorbs the heat that it generates itself. The electrolyte is then pumped to a watercooled heat exchanger, where the energy is removed from it by cooling. The heat generated in it between the electrodes is liberated outside this zone. Cooling coils are sometimes used directly in the rheostat tank.

In both cases, the heat-generating and heat-dissipating zones are entirely separate. In the usual rheostat design, heat is generated in the resistive element and must be liberated directly from the same element. This means the current-carrying ability, as well as the ability to dissipate heat, controls the design of the rheostat.

3. Large amounts of power can be handled readily, as the cooling means (cooling coils in the tank or heat exchangers outside the rheostat) is usually small for liquid-to-liquid heat exchange, as contrasted to the volume required for natural convection or forced-air coolers.

4. Large currents can be handled easily at phase voltages up to 5000 volts.

5. Sliding contacts are eliminated. The current-carrying ability is usually limited by heating of these contacts. The problem of wear and contact resistance variations of sliding contacts is eliminated.

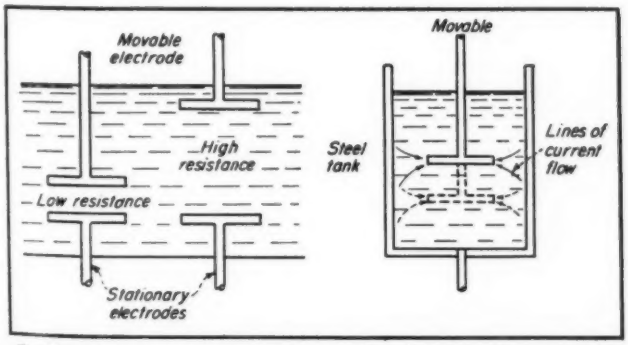
Tank Construction. Because the lower electrodes are not completely insulated from each other, the open-cell design is used only for relatively low resistances at maximum electrode spacings. When high resistance is required, a closed-cell construction is used in which the lower electrodes are completely insulated from each other.

For both open-cell and closed-cell designs the individual cells are mounted in a common tank. This design serves to equalize the temperatures in all the phases and provides a high thermal-storage capacity. Usually the open-cell design is used for constant-torque loads, whereas the closed-cell construction is for centrifugal-fan and compressor loads where high resistance per phase is required.

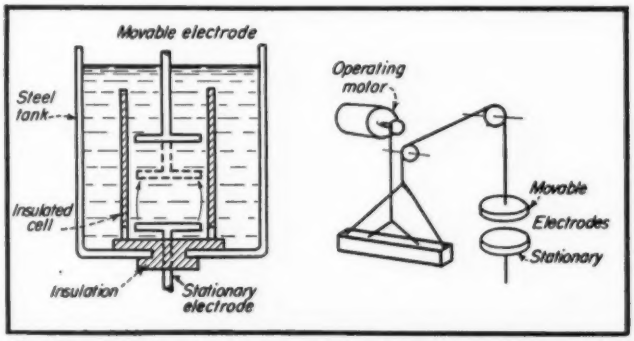
The Electrolyte. After many years' experience, sodium carbonate, dissolved in clean water has proved an extremely satisfactory electrolyte. It not only prevents corrosion of metal parts but is low in cost and easily mixed. Castbronze electrodes are used in this solution.

Resistance between electrodes for any given gap depends upon the concentration of the sodium carbonate in the electrolyte and upon the temperature of the solution. Curves in Fig. 5 show the variation in resistance due to these two factors.

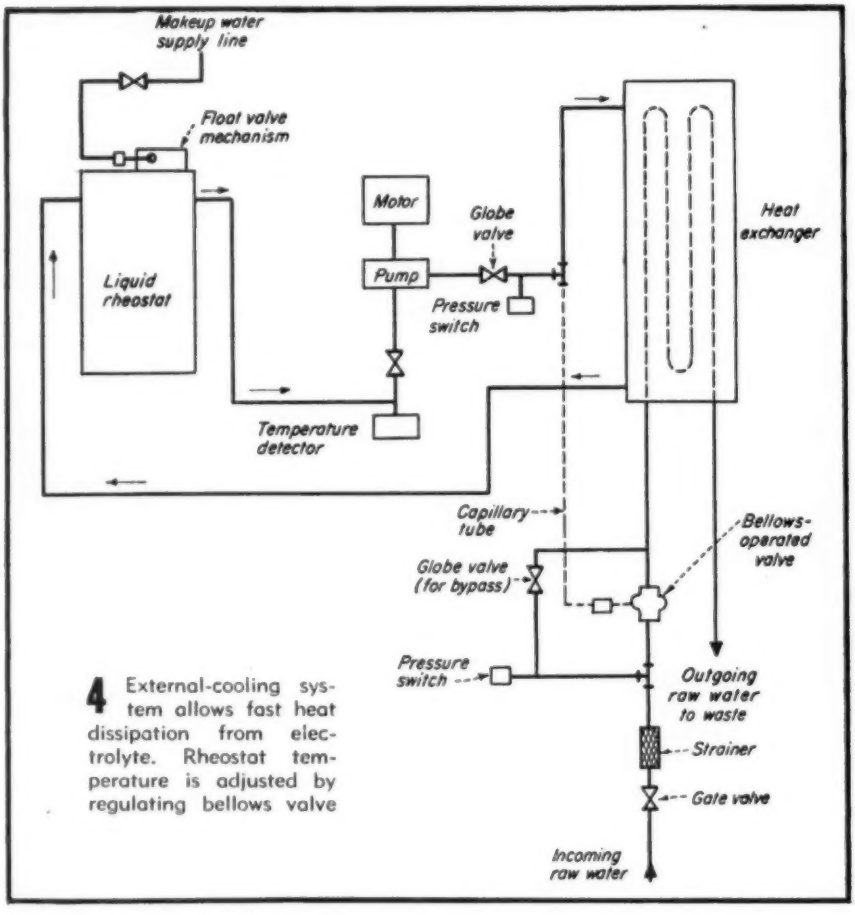
The resistance between electrodes also depends upon the current density (amperes per square inch) at the electrodes. Resistance is decreased approximately 8 to 14% when the current density is increased from 3 to 10 amp per square inch of electrode area. Since the temperature and concentration of sodium carbonate has a much greater effect, as seen in Fig. 5, the variation in resistance due to current density is



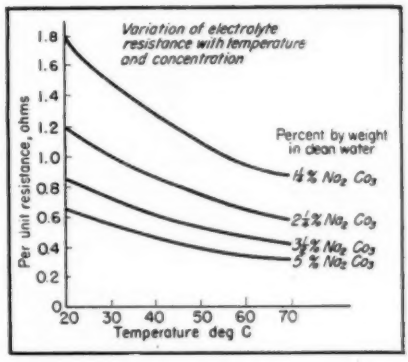
2 Resistance varies directly as the distance between electrodes. Stationary electrode must be insulated from tank



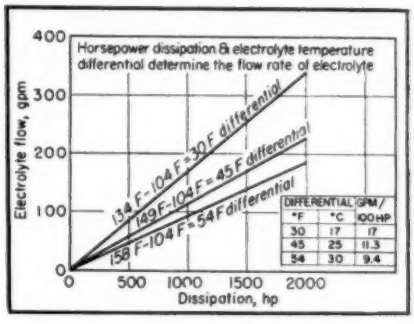
3 Counterbalancing the movable electrodes permits reduction in the size of the operating motor or hydraulic cylinder



4 External-cooling system allows fast heat dissipation from electrolyte. Rheostat temperature is adjusted by regulating bellows valve


Variation of electrolyte resistance with temperature and concentration
Per unit resistance, ohms
Percent by weight in clean water
4% Na2 Co3
2½% Na2 Co3
1½% Na2 Co3
1% Na2 Co3
Temperature deg C

5



6

not included, in the graph shown above.

Curves in Fig. 5 show that at 65 C resistance is roughly 50% of that at 20 C. In other words, the electrolyte has a negative temperature coefficient of resistance.

Since the operating mechanism adjusts the gap between the electrodes to hold the required resistance, changes in resistance due to temperature may be compensated for automatically.

Cooling. As already indicated, heat loss in the rheostat (I^2R loss due to flow of current) is generated within the electrolyte itself. This energy must be removed from the electrolyte at the same rate that it is generated to maintain constant temperatures.

Fig. 4 shows a piping layout of a typical installation with external coolers. The electrolyte's circulating pump operates at a positive head above the intake. Since no air pockets are allowed to accumulate in the piping system at any point, sump tanks and simliar devices are not required for successful operation of the rheostat.

The over-temperature relay provides protection against excessive electrolyte temperatures. A control may be used whereby the temperature of the electrolyte ahead of the cooler controls the cooling-water flow. The temperature of the electrolyte is thus maintained at a constant value and a minimum amount of cooling-water flow is used.

For any given horsepower dissipation, the electrolyte flow depends entirely upon the temperature differential, or difference between hot and cold electrolyte temperatures in the system. Curves in Fig. 6 show that the maximum flow of electrolyte is required for the smallest differential in temperature. Cooling-water flow, required by the heat exchanger to limit the temperatures between the values given, depends entirely upon the specifications of the heat-exchanger manufacturer. Approximately 11.3 gal per minute of electrolyte must be circulated per 100 hp dissipation for an average value of 25 C temperature differential between the hot and cold electrolyte.

Typical Operation. To better understand a liquid rheostat's operation, let's use it to control speed, Fig. 4, in starting and running a slipring motor:

1. Open gate valve in incoming raw-water line to provide cooling water.
2. Start electrolyte pump.
3. Raise electrode to the top or maximum gap position. This trips the interlocks on the pulley wheel, which in turn allows closing the primary control on the motor. The motor cannot be started unless the movable electrodes are in the maximum resistance position.
4. Close primary control.
5. After the motor has started, the electrodes are lowered to obtain the desired operating speed.
6. For maximum speed, the electrodes are lowered to the minimum gap (minimum resistance) position. As the movable electrodes approach the stationary ones, mechanical stops on the upper assembly prevent upper and lower electrodes from touching.
7. The bellows-operated valve, controlled by the electrolyte temperature from the regulator, keeps the cooling-water flow at a minimum for the desired setting of electrolyte temperature differential. Cooling-water flow varies directly with the energy being dissipated by the rheostat.
8. To lower the motor speed, the movable electrodes are raised to the desired speed setting.
9. The primary control is used to disconnect the motor from the rheostat.

Surface Water Made Fit for Boilers

Supplying all water needs for a large-scale refinery is a major problem. Esso Standard Oil Co draws its water from surface and ground wash, says A L Wilson, power-plant chief engineer, and then prepares it for corrosion-free service

▶ WATER NEEDS at Esso Standard Oil Company's Bayway Refinery in Linden, N. J. require a soundly engineered yet highly flexible system.

Raw-water supply consists of surface waters collected in a system of retaining basins. Usual treatment for such waters involves heavy filtering. Not so at Bayway.

Here pumps pull water into a cold-storage tank from which it flows into a cold well. This point supplies power-plant cooling-water needs for generator air, bearings, oil cooling. Returns from this service join other waters from the cold well at a second well.

Pumps pull from this level to a collecting tank. This same tank receives (1) condensed flash steam from the boiler blowdown-recovery tank (2) cooling water and condensate from process (3) hot water from compressors and similar steam-driven equipment (4) intermittent excess exhaust steam passed through a barometric condenser. Average temperature of tank runs about 130 F.

Next comes the chemical-treatment or, more exactly, coagulation stage. A series of five reaction tanks, 30-ft dia x 30-ft depth, act as mixing chambers for incoming raw water and a varying amount of chemicals consisting of lime, sodium aluminate, soda ash, iron sulphate, caustic soda. Sediment, settling in bottom of these tanks, amounts to 8 to 12 tons per day.

COAGULATION PROCESS

Surface waters carry considerable finely divided and suspended matter in a colloidal state. Chemicals mentioned above speed the settling of this suspended matter. The floc or the jelly-like mass, which binds together silt, bacteria and other organic material in suspension, does not remove hardness or dissolved gases. For that reason still additional equipment stands between the water and its final service.

Actual chemical dosage varies with temperature and nature of water. Both of these vary somewhat depending on various factors like season of the year.

Usual arrangement calls for a filtering operation on water leaving the floc-formation tanks. Function of filtration is to clarify the water. At Bayway, however, use of five reaction tanks, scheduled cleanings, a sufficiently long stay within a tank for complete settling, all combine to give a water clear enough for plant service.

FEEDWATER FLOW

An emergency feed line connects from the outlet of the five reaction tanks direct to boiler feed pumps. But normal routing follows this procedure.

A pair of deaerating tank heaters, unique in design, stand between sedimentation tanks and boiler feed pumps. These deaerators receive normal condensate and exhaust from plant services in addition to incoming makeup water —about 80% of total.

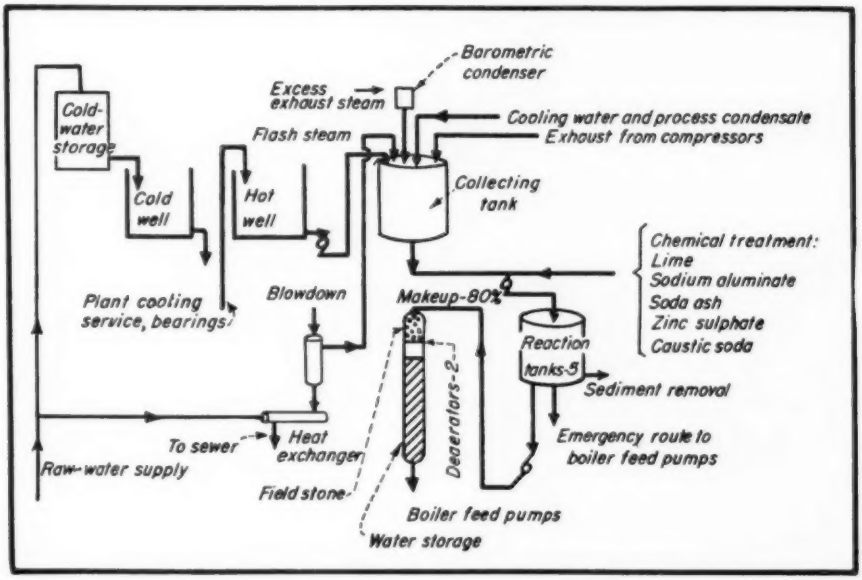
These parallel-connected tank heaters are 10 ft dia by 36 ft long. They stand on end so, carrying their normal level of water, they furnish a good positive head for feed pumps. In addition, they hold roughly a 20-min supply under usual 850,000-lb-per-hr water demands. An alarm system, which rings in both pump room and at heaters, acts as an operating precaution against a falling water level.

HEAT EXCHANGE

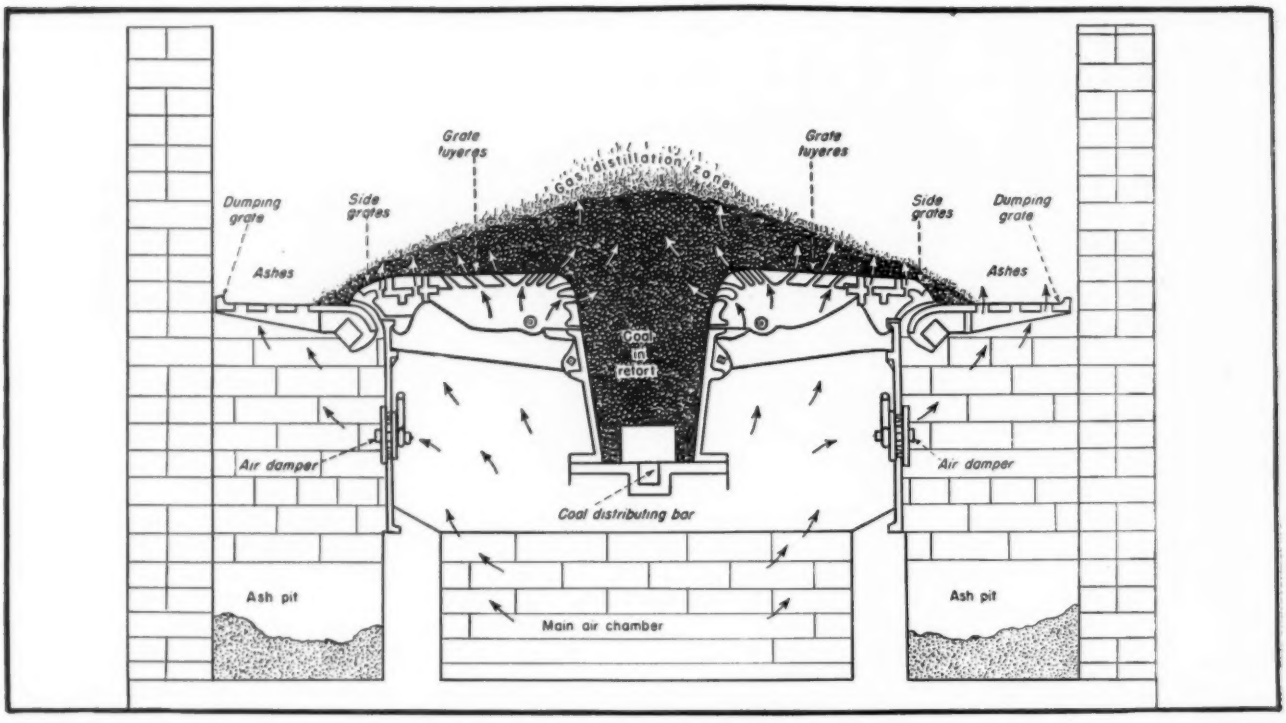
A very interesting and unusual deviation from general practice is loading these deaerators with field stone of about 6-in. dia. Its presence as a heat balancer plus the 20-min reserve permits water held at 212 to 215 F to rid itself completely of all dissolved gases.

This deaerating heater holds water temperature constant at the higher level with field stone as a heat-balancing medium. A larger water storage than usual plus a constant water temperature gives complete deaeration. It has paid excellent dividends.

This plant has employed steel economizers for over 25 years and has yet to lose a tube to internal corrosion. Feedwater lines, boiler parts, heaters and such auxiliaries have enjoyed the same record.



SURFACE WATER collected in retaining basins acts as raw-water supply source. Flow diagram above shows preparation stages to fit water for refinery and boiler



1 Single-retort stokers introduce coal through a central feeding trough. The coal moves along the furnace by ram action, sidewards by gravity and pressure of incoming coal. Air supply passes through grates and fuel bed under pressure

Underfeed Stokers Are Meant

Do your part and they'll do theirs. Underfeed stokers are inherently free of cinder and flue-dust problems, but poor operation or overloading upsets this condition. Here are facts you need if operation, fuels, firing are to stay troublefree

By L N ROWLEY, *Managing Editor*, and J C McCABE, *Assistant Editor*

▶ OUR LAST ARTICLE looked into fuel-bed firing (POWER, March 1948, p 88). Of the two mechanical forms—overfeed and underfeed—it dealt with overfeed firing only. Underfeed stokers, which we consider here, represent one of the more widely used means for firing bituminous coal.

To set up guides for good, smokefree operation, let's take up (1) the stoker itself and (2) the combustion process.

Underfeed stokers come in two broad classifications—the single retort and the multiple. The single retort works with units up to a steaming capacity of 25,000 lb per hr, and sometimes as high as 40,000. Multiple-retort units are in service for capacities from 30,000 up to 500,000 lb per hr.

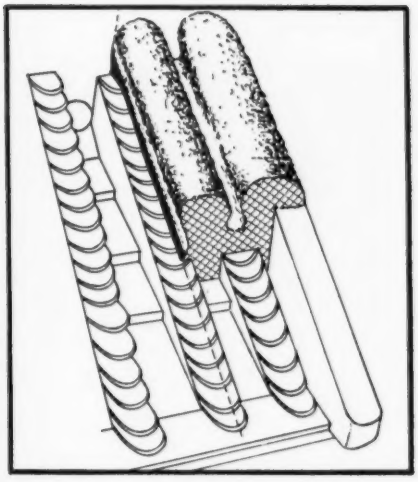
Single-retort designs follow three basic forms. All employ a central retort, Fig. 1. Two have stationary fuel grates on each side of the central retort, and the third has mechanically actuated moving grates on either side.

Types one and two differ principally in ash removal. The first, now employed on small units only, has dead plates at the extreme sides. Ash is removed by hoe through the furnace doors. The second has ash-dumping grates at these extreme sides and collecting pits under each grate.

The third type with moving fuel-burning grates employs ash-dumping or discharging grates at the extreme furnace sides and ash-collecting pits.

One word of caution on fuels: Double screening to reduce fines is advisable for single-retort stokers equipped with stationary grates.

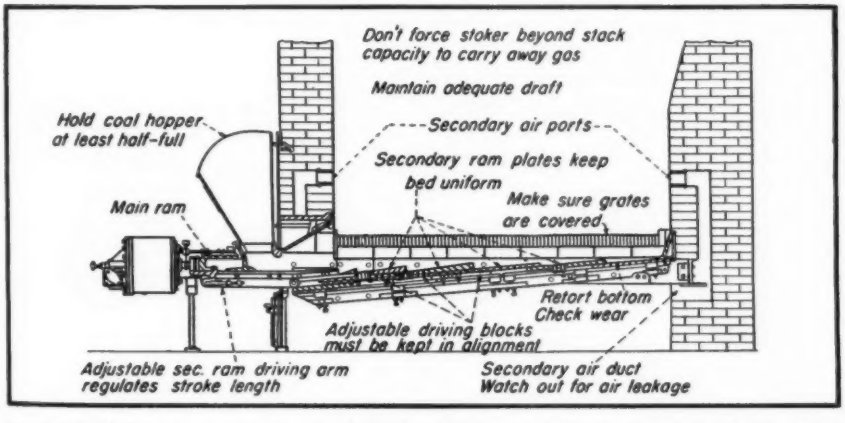
Here's how combustion takes place. The central retort serves as a feeding trough or supply channel for introducing coal beneath the fuel bed.



2 Hills-and-valley contour characterizes the multiple-retort fuel bed. Heavy hills of coal cover retort section. Thin valleys lie over tuyeres

3 Watercooling of underfeed stoker's fuel bed is said to (1) extend the fuel flexibility (2) reduce the maintenance (3) reduce the clinker formation

to Operate Smokefree


Don't force stoker beyond stack capacity to carry away gas
Maintain adequate draft
Hold coal hopper at least half-full
Secondary air ports
Secondary ram plates keep bed uniform
Main ram
Make sure grates are covered
Retort bottom Check wear
Adjustable driving blocks must be kept in alignment
Adjustable sec. ram driving arm regulates stroke length
Secondary air duct Watch out for air leakage

4 Spotted here are various equipment points to check in keeping either single or multiple-retort stokers operating in the way that they should—smokefree

A ram, plunger or movable-retort bottom with the aid of secondary reciprocating elements (or in other models a screw-feed system) pushes coal rearward and upward to the fuel-burning grates. Coal feed is usually varied by changing time of feed stroke and leaving length of stroke always the same.

Incoming coal leaves the retort and travels over the grates toward the sidewalls. With stationary grates its movement depends in part on gravity and for the rest on the pressure of additional incoming coal. Mechanically moving grates add to these forces.

Air supply passes through the grates and fuel bed under pressure. Since the grates usually extend into the retorts a short distance, incoming air also passes through the top section of the fuel supply to perform some drying of wet coal.

There is a certain amount of zone-feed for incoming air. It is accomplished by various air-chamber arrangements or hollow grates to give an even fuel-bed distribution. But the majority of the air goes up through the fuel bed close to the retort. At this point it serves the useful purposes of promoting (1) rapid ignition (2) maximum mixing between air and volatile released from the heated raw coal. Some installations put overfire nozzles in the rear or front walls for added turbulence.

The zone of active combustion covers all the grate area. With narrow stokers the active zone reaches the area directly above the retort itself. Usually, though, ignition starts where the coal passes beyond the retort boundaries. Burning progresses as coal travels towards the furnace sides.

Clinkering difficulties can develop along the sidewalls at the grate level if a coal having a lower ash-fusion temperature than the design one is substituted. Watercooled sidewalls reduce troubles from this source and thereby extend the range of suitable coals.

Furnace size should be ample for shortest flame travel. Furthermore, boiler and stoker should be coordinated. Shortest flame travel runs about 4 ft for small stokers and up to 8 for large-sized ones. An allowance of an

TIPS FOR STAYING SMOKEFREE

1. WATCH FUEL-SIZE CONSIST
2. AVOID SEGREGATION
3. MAINTAIN PROPER DRAFT
4. DON'T OVERLOAD
5. PROVIDE ENOUGH FURNACE VOLUME

PERMISSIBLE MAXIMUM BURNING RATES

Any Make Single-Retort Stoker, Eastern U. S. and Canadian Coal

			Maximum Lb/sq ft/hr*
Base stoker: Single retort, Stationary grate, Refractory, Walls	Base fuel: Size 1¼x0 in., 8.7 ash, 2050 a-s temp, 13,200 Btu-Ar	Base	20
With grate agitation in fuel bed		Add	5
With completely watercooled furnace		Add	5
When substituting double-screened coal like 1¼x⅜ in.		Add	5
Most favorable maximum			35

* Furnace dimension

added foot gives greater fuel flexibility. Table on this page gives recommended burning rates.

MULTIPLE-RETORT STOKERS

Ash-removal methods furnish a convenient means for classifying multiple-retort stokers. They all use one of three methods: (1) dump grate (2) rotary-ash discharge or clinker grinder (3) continuous ash discharge.

Coal, stoker size and character of load influence selection of ash discharge. Dump-type units usually appear on smaller-sized installations employing low-ash coals where intermittent dumping does not upset load much.

Rotary or clinker grinder ash-discharge equipment permits (1) continued operation without the rush of excess air, (2) ash removal without making smoke. Stokers, using high-ash coals and meeting continued high-capacity steam demands, find this system of ash removal a desirable one.

Continuous ash-discharge equipment allows a more uniform fuel bed than possible with other discharge devices. An extension or overfeed grate section serves as the last part of the active fuel bed. It may operate from the main drive or be independent. The drive may be electrical, mechanical or hydraulic.

Control of fuel-feed rate comes not only from varying the stoker speed but also from adjusting the stroke length of secondary rams or pushers. These two controls also permit varying or holding fuel-bed thickness. For instance, if the fuel bed tends to build up in the front end, an increase in stroke length of secondary rams corrects this condition. Too thin a fuel bed requires speeding up the stokers to thicken it.

Just what does the fuel bed look like and how does combustion take place? In a true underfeed section a hills-and-valley contour characterizes fuel bed shape, Fig. 2. The hills are directly over the retorts because they are the supply channels for incoming coal and, moreover. have no flow of air entering through them, whereas the tuyeres have an exactly opposite condition, Fig. 5. Almost all the incoming air supply passes through them and only the lateral overflow from neighboring retorts feeds coal over their surfaces.

Coal enters the furnace zone much the same as under single-retort operation. It moves down the furnace length under the action of secondary rams.

Lateral movement of the coal from the region above the retort over to the tuyere rows depends on gravity and the pressure of incoming coals.

Under such a coal-supply system the early coking and plastic stage occurs by and large over the retort. High combustion rates on a thin and active fuel bed generally describe conditions over the tuyeres, Fig. 5.

For this reason some manufacturers include an extension grate. While it is a form of overfeed firing, this grate acts in the interest of a uniform fuel bed by shaking down and leveling out hills.

Usual fuel thickness over the extension grate runs 6 to 8 in. for free-burning coals, and 8 to 10 in. for heavier caking coals. With any system the ideal fuel bed is thin, homogeneous. porous.

Today preheated underfire air is generally accepted as desirable. It permits a higher rating, and a moderate preheat materially increases range of output. The only limits placed upon it are those of maintenance. The higher the preheat, the higher the maintenance costs. Holding preheat temperature to about 250 to 300 F gives good results.

Next the matter of air distribution. Zoned-air distribution, which allows varying air flow to meet the different resistances through the fuel bed at different points across the grate, is widely used. A metered control of distribution, rather than purely manual, reportedly gives (1) a higher attainable combustion rate (2) less stoker maintenance through fewer burn-outs (3) increased efficiency from a lower excess-air requirement (4) almost complete elimination of smoking tendencies.

Some report a further extension of fuel-burning rates, and also flexibility from using watercooling, Fig. 3. Some designs place cooling tubes directly over tuyeres and down into the extended grate section. Watercooling tubes may be put (1) into the retorts themselves (2) along the sidewalls (3) across the back wall leading into the ashpit.

What can be done to keep these stokers performing as they are meant to? Biggest contributors to failures and to smoke are: (1) sustained or frequent overloading (2) improper draft.

A change to a higher-quality coal reduces effect of overload. But, in any event, keep the fire out of the retort. If this happens, the fuel bed may be too thin, the hopper may not be kept loaded, or fuel for banking be too light.

Always watch for uniform fuel feeding over the grate. Change position of secondary rams or pushers until fuel is uniform. In line with this precaution see that grate-bar ends are always covered. It may be necessary to speed up the stoker after dumping ashes to keep them covered. Don't remove ash or clinker that stays on the grate bars after dumping. Let the normal operation of the stoker bring them down to the dump grates.

Keep an eye on fuel-bed thickness. Too light a bed produces retort troubles. With too heavy a fuel bed, fires become uneven, air distribution falls down, holes develop, smoke forms. For single

retorts fuel should run from 4 to 8 in. deep above the retort, depending upon the coal. It should be from 16 to 20 in. over the tuyeres with multiple retorts.

Don't work a fire any more than necessary. Even the fuel bed out by lightly raking the surface. Forget the slice bar. Make sure siftings are removed from windboxes. When shutting down, feed in enough ash to keep the fire out of the retort.

Now for draft. First step in judging it comes through a system of combustion controls. Draft gages, CO_2 indicator, and controls over stoker speed and draft settings are most helpful.

Hold overfire draft to about 0.1 in. A rule of thumb for underfire draft sets 0.1 in. for each 10 lb of coal burned per sq ft of grate per hr. In any event keep the ratio of air to fuel at the proper level.

Always keep a flow of air through the grates except on bank. Never force a stoker beyond the stack capacity to carry away furnace gas.

If overfire draft runs low, check (1) for leaks in the setting (2) draft losses in boiler and flue connections (3) damper position (4) windbox seal for air leakage.

Preventive maintenance also goes a long way towards troublefree operation. Inspect all parts frequently, accessible ones daily, and inaccessible ones during scheduled outages.

In operation look especially for loose bolts and connections in moving parts. With shear pins or safety releases make certain they do not bind.

During shutdown, check wear on feeder-box sides, retort, conveyor tube. Replace if they are getting thin. Check alignment and wear on moving parts.

With moving grates look for growth cutting down clearances. Small stokers need 1½ in. for grate bars; large ones, 2 in. Some stokers have adjustments to compensate for growth. Use only hand pressure when making these adjustments. If no adjustments are available, remove grate or filler bars to give the necessary clearance.

With multiple-retort units, check adjusting mechanism on secondary rams and overfeed section, if you have one. See that travel corresponds with indexing plate at the stoker front. Also, compare stoker dampers in closed, open and intermediate positions with control settings.

FUELS HANDLED

Underfeed stokers as a class furnish a rugged and dependable means of burning most grades of semibituminous, bituminous, subbituminous and lignite coals. Single-retort designs also handle anthracite. A studied consideration of size consist, coking and caking characteristics, chemical analysis and expected burning rates at the planning stage gives good operation.

Coal size is not too critical but preferred choice limits size within a ¾- to 2-in. top size. Usual specifications call for 2-in. nut and slack with no more than 50% through ¼-in. round-hole screen. Reduction of percent of fines promotes flexibility by extending possible choice of fuels for satisfactory performance. The desired aim, of course, is to get a coal sizing that gives rapid ignition, and a porous and uniform fuel bed.

Now for a look at coking, caking and free-burning properties.

Strongly coking coals are the ones that "mat over." Caking coals do the same to a much lesser extent. Unless means exist to keep dense, nonporous coke pieces moving and broken up the fuel bed becomes nonuniform and clinkers form. The underfeed stoker offers a satisfactory means for burning caking coals.

Caking coals become free-burning at high rates of combustion, beyond the point where tar burns as fast as it melts. This is the point where the fuel bed no longer holds together and "popcorning" develops.

In addition to the effect of firing rate on caking, size consist also affects it. With a bituminous coal the higher the percentage of fines or, to put it another way, the finer the coal size, the stronger the caking action.

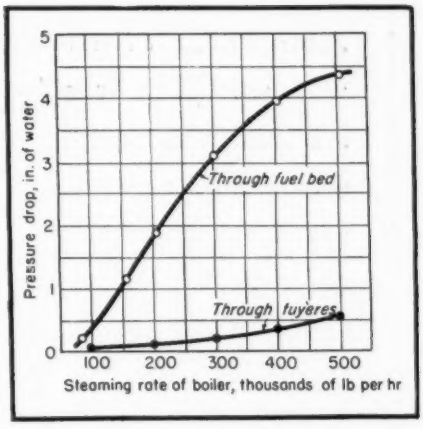
Clinker formation depends on several factors including iron content and ash-fusion temperature. Softening and fluid temperature of ash are affected by furnace atmosphere—oxidizing or reducing. A reducing one, such as occurs in stoker firing, will lower the fusion temperature.

What makes a desirable ash content? For underfeed stokers ash content should run at least 4 to 5% to assure adequate grate protection. Too high an ash-content fuel penalizes underfeed stokers somewhat. Ash-stay within the furnace is said to be four or five times as long as with overfeed stokers.

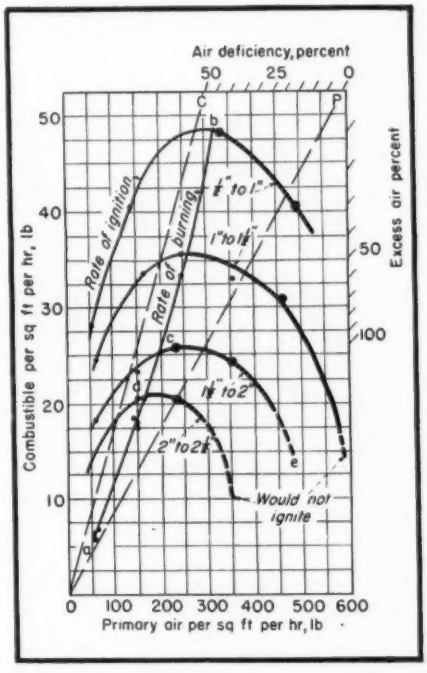
Because these various coal properties loom large in good operation some have tried burning mixtures of different coals with the idea of combining features.

Segregation must be guarded against with any fuel and particularly so with a mixture. Concentrations of different fuels in different places on the fuel bed produce a nonuniform fire. To fire a mixture successfully requires detailed analyses and confirming test runs. To avoid segregation (1) maintain hopper at least half full (2) fill it by mechanically operated spouts, traveling larries or nonsegregating chutes.

Just where do burning rates fit in? Maximum rate of ignition for the particular coal sets the absolute peak burning rate. But clinker formation fixes the practical upper limit. Other contributing factors—cinder emission, air distribution throughout the fuel bed, coal drift—exert lesser limitations on burning rate. Cinder emission is normally no problem. If firing rates make it one, a low draft-loss collector usually helps.



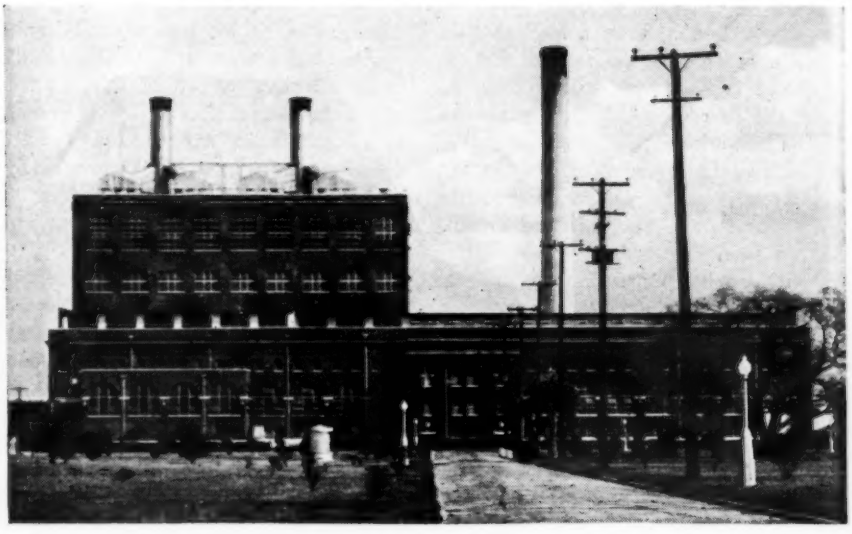
5 Pressure drop through tuyeres, fuel bed of metered-air-controlled stoker


Air deficiency, percent
Combustible per sq ft per hr, lb
Excess air percent
Rate of ignition
Rate of burning
Would not ignite
Primary air per sq ft per hr, lb

6 Ignition and burning rates change as primary air rates, sizes of coke vary

Jacksonville, Florida will use preferred standard turbine-generators with one boiler per turbine arranged on the unit system. Semioutdoor design places 850-psig 900-F boilers, fans outside

By **HERBERT McCLAMMY**
Mechanical Engineer, associate of Reynolds, Smith and Hills



TALLEYRAND AVENUE PLANT with five turbine-generating units totaling 81,500-kw installed capacity is the largest municipally owned generating station in South

One of South's Largest Municipal

► FROM A BEGINNING IN 1895, when the City of Jacksonville took possession of a new plant in Waterworks Park, the electrical system of the city has grown to be one of the largest municipally owned utilities in the South. Increasing demand for service rendered the original plant wholly inadequate by 1911. Construction of the Talleyrand Avenue Station was initiated and completed at a cost of about $635,000. When this plant started operating on Oct. 12, 1912, the Waterworks Park plant was converted to a substation.

The initial Talleyrand Avenue Station consisted of two 1500-kw generating units supplying power at 6.6 kv. Subsequent installations were: two 1500-kw units and one 4000-kw unit No. 4 in 1918; raising station capacity to 10,000 kw. The latter unit, still in place, has sometimes aided in carrying the peak load.

The four 1500-kw sets have been displaced by these units: No. 1. 10,000 kw on Mar 14. 1921; No. 5, 12,500 kw on Sept 24. 1924; No. 6. 25,000 kw on Jan 2, 1928; No. 7, 30.000 kw on Mar 7. 1939, bringing station capacity to its present 81.500 kw. Station voltage was changed from 6.6 to 13.2 kv with the installation of No. 1 unit.

Increasing service demand and wartime construction restrictions accelerated equipment depreciation. Lack of labor was reflected in the serviceability of equipment; in 1945 No. 4 was no longer considered safe for operation and has not been used since.

Floating Power Plant. It became necessary to lease from the federal government one of the four 30,000-kw floating power plants, the "Inductance," built for just such emergency service. This plant raised system generating capacity available for service to 107.500 kw and the net assured capacity (largest unit out of service) to 77,-500 kw. Thus the city avoided the possibility of rationing power to certain industries.

After an appreciable rental had been paid for the floating plant for about a year, the commissioner of utilities, George A Pierce. instituted negotiations ending in its purchase by Jacksonville in 1946. This resulted in an increase in the city's over-all revenue.

Graph on page 90 shows the system load growth from 1931 to date, and expected future expansion together with proposed capacity additions. The city has long contemplated utility additions to promote further development of Jacksonville and the surrounding territory. page 89. industrially and residentially. In 1947. $15,000,000 in Electric Revenue Certificates were issued to finance the construction of 60,000-kw additional generating equipment, substations, underground and overhead distribution, and the modernization of existing equipment.

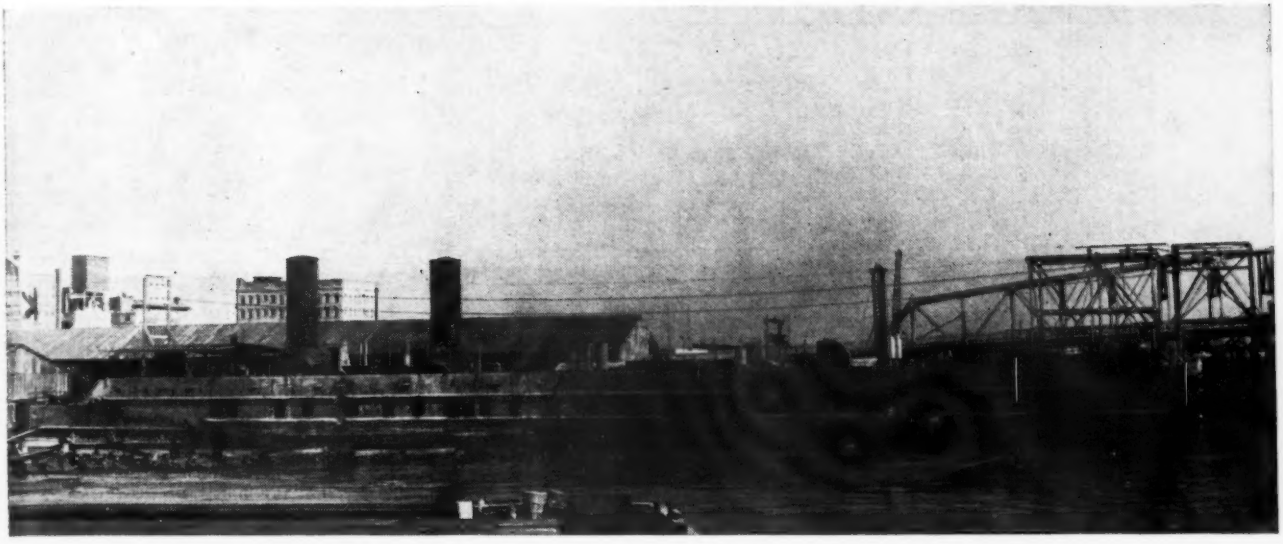
New Generating Plant. In South Jacksonville on the St. John's south bank, p 89, the new plant will be designed for base-load service to deliver 60,000 kw at 13.8 kv less losses to an outside substation. Each turbine will be supplied by its own boiler arranged on the unit system. There will be an emergency interconnection between boilers, any feedwater pump of the two units can serve either boiler. The 30,-000-kw 85%-pf Westinghouse turbine-generators will be built according to the preferred standards promulgated by AIEE and ASME.

Provisions will be made for the future addition of two 30,000-kw units. Should conditions warrant, these units could be 40,000 kw each installed in the same space.

The two oil-fired boilers will have a continuous rating of 300,000 lb per hr each at 850 psig, 900 F. Each unit will have waterwalls, superheater. air heater, superheat control, steam purifier, soot blowers, combination oil and gas burners and steel casings for outdoor protection.

Fuel Handling. Three 62,000-bbl oil-storage tanks will realize savings in fuel cost by bulk purchase of complete tanker loads at one time. Full tanks will supply fuel for over 30 days of normal operation. If plant capacity is eventually doubled only one additional tank need be built.

A concrete slab over a substructure supports each tank. An earthen dyke surrounding each tank will hold its contents in case of leakage. An oil-



FLOATING POWER PLANT "INDUCTANCE" with 30,000-kw. capacity was added to Jacksonville system in 1945 to help carry rapidly growing load. Originally leased, it was bought from the federal government in 1946 for price of $2,500,000

Utilities Plans 60,000-Kw Station

transfer pump house will be provided at the bulkhead line adjacent to the unloading wharves.

A T-shaped wharf will accommodate tankers and barges being unloaded at the eastern end of the plant.

Two motor-driven fuel-oil unloading pumps, 300-gpm 25-psi head each, will take fuel oil from tank cars and discharge it to the storage tanks. Four motor-driven oil pumps, 25-gpm 265-psi head each, will take oil from the storage tanks and force it to the burners through oil heaters. A differential oil pump regulates pressure at the burners and bypasses oil to the fuel-oil-pump suction.

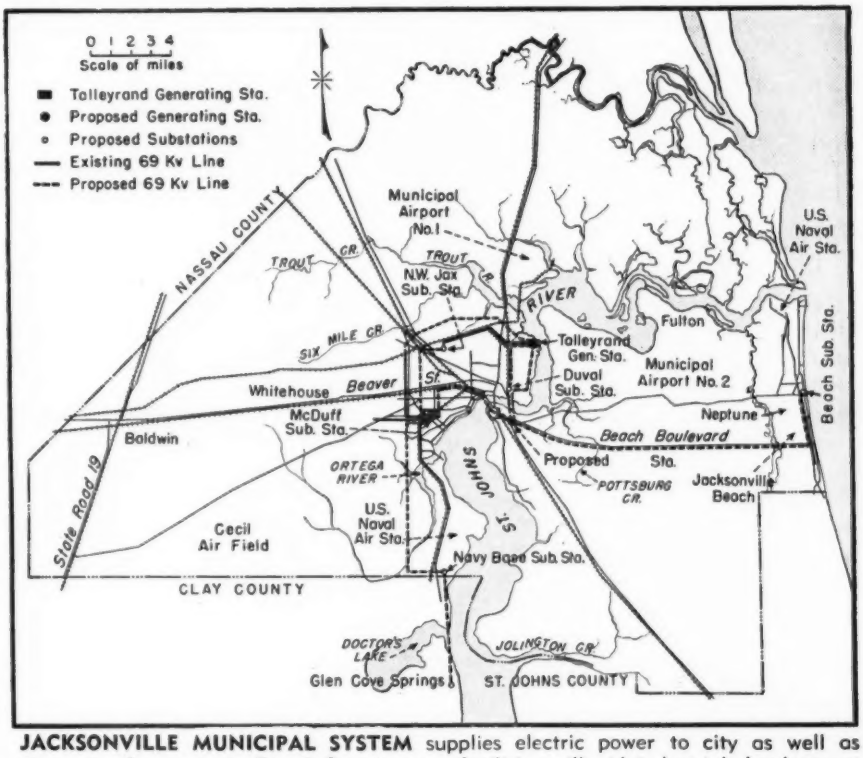
Two heaters will raise oil temperature from 80 to 280 F, each heater having its own temperature-control unit. Steam and condensate lines supplying tank heating will trace the fuel-oil lines from tank to plant.

Auxiliaries. Four bleed points in the turbine will supply steam for regenerative feedwater heating. Pumps and fans of both units are motor driven to utilize the higher efficiency of the main turbines and eliminate the cost of piping if auxiliaries were steam driven.

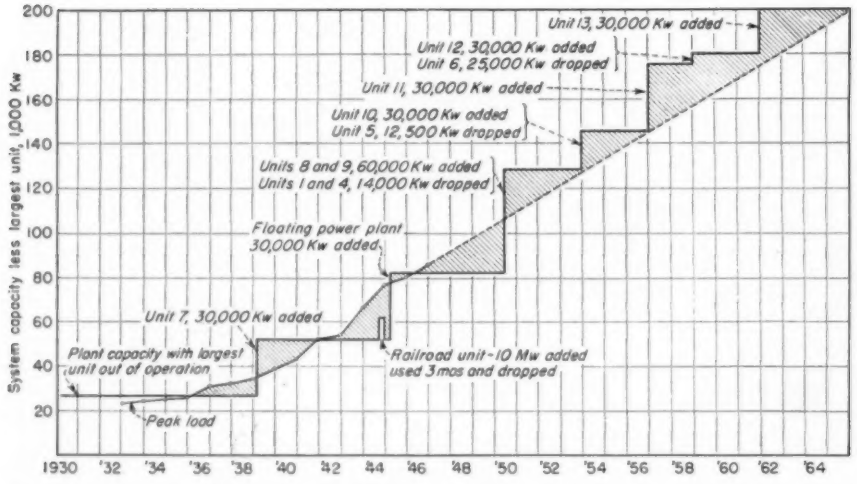
Two or more surface wells will supply plant service requirements. Each will be equipped with a motor-driven pump discharging into a reservoir.

Four vertical pumps in the river-water-intake structure will take water from the river and discharge into individual cast-iron conduits connecting to the condenser inlets. These pumps will be installed on a concrete intake structure with a gantry frame serving the four pump wells. Each pump well will be completely equipped for normal operating, cleaning and maintenance purposes with a bar-grill trash rack, sluice gate with frame and operating mechanism, and a traveling screen with backwash pump and jets.

The four cast-iron conduits from pumps to condensers will lie under-



JACKSONVILLE MUNICIPAL SYSTEM supplies electric power to city as well as to surrounding area in Duval County; new facilities will aid industrial development



RAPIDLY ACCELERATING LOAD-GROWTH RATE since 1941 shows urgent need for additional generating capacity; some load will be dropped if largest unit is lost

ground and under the floor. Discharge conduits from the condensers will be similarly located and will connect to the discharge flume along the river bank. Each intake conduit will be of 36-in. diameter, supported on piling and concrete slab. Shear gates will be at the flume end of each discharge and intake conduit.

The discharge flume, about 260 ft long and 15 ft wide, will be reinforced concrete and sheet piling supported on rock. The flume will release the heated circulating water over 250 ft downstream from the intake head house.

The yard substation will step up voltage to 69 kv for transmission to the main distributing substations in the city and for local distribution at 13.8 kv. Electrical switchgear is so arranged that power may be supplied for starting up motor-driven auxiliaries from three external sources.

Station Building. Construction will be semioutdoor, with a building enclosing the turbine room and the boiler firing aisle to the face of the boilers. Boilers and fans will be outdoors.

Substructure will consist of a reinforced concrete mat extending under the turbine room and outdoor boilers supported on concrete piling, driven to rock. Slab under the boiler will be 30 in. thick, and under the turbine pedestals 48 in. thick with the remaining portions under the turbine room 15 in. thick.

Building proportions in terms of width x length x height in feet are:

Office	25x 88x41
Electrical bay	22x141x41
Turbine room	55x141x64
Boiler operating aisle	16x141x63

Superstructure will consist of a structural steel frame with masonry walls, concrete floors and roof, glazed tile wall and quarry tile finish for the turbine room. Partitions for toilet, locker rooms and other enclosures will be provided within the building.

Turbine room and electrical bay will have ventilation, and the office will have comfort-type air conditioning.

A 75-ton 50-ft-span station crane with 15-ton auxiliary hook will serve the turbine room. One 5000-lb 100-ft-per-min elevator will extend from the first floor to the building roof.

General Improvements. The contemplated site of the new plant is at an elevation somewhat less than 7 ft above mean low water. To protect the shore from erosion by river water and to permit construction of foundations, flumes and conduits along the river bank, a bulkhead of steel-sheet piling about 1500 ft long will be constructed. Certain areas beyond the pierhead line will be dredged to provide a deep river-water intake and a channel deep enough to permit docking fuel-oil tankers. The ship-docking area will be dredged to a depth of 34 ft to accommodate standard tankers.

A railroad spur-line siding will handle incoming equipment, and also oil-tank cars if this becomes necessary. The spur line will pass through the plant structure and into the switch yard, to unload materials near the points where they will be used.

Eighteen-foot roadways will be provided around the plant proper and along the bulkhead to the unloading wharves. Concrete sidewalks will be laid from the street to the office; parking area will be adequate for employes and visitors. The property will be completely enclosed, except on the river front, with a standard industrial fence.

Floodlights will illuminate roadways and portions of the property where equipment is located. These lights will be mounted on high structures with no separate pole lines required.

Water for domestic use and emergency plant needs will be taken from the city water-supply system. Storm sewers for property drainage will not be needed, but drains from the plant structure will discharge to the flume entering the river. Proper grading will provide yard drainage directly to the St. Johns River.

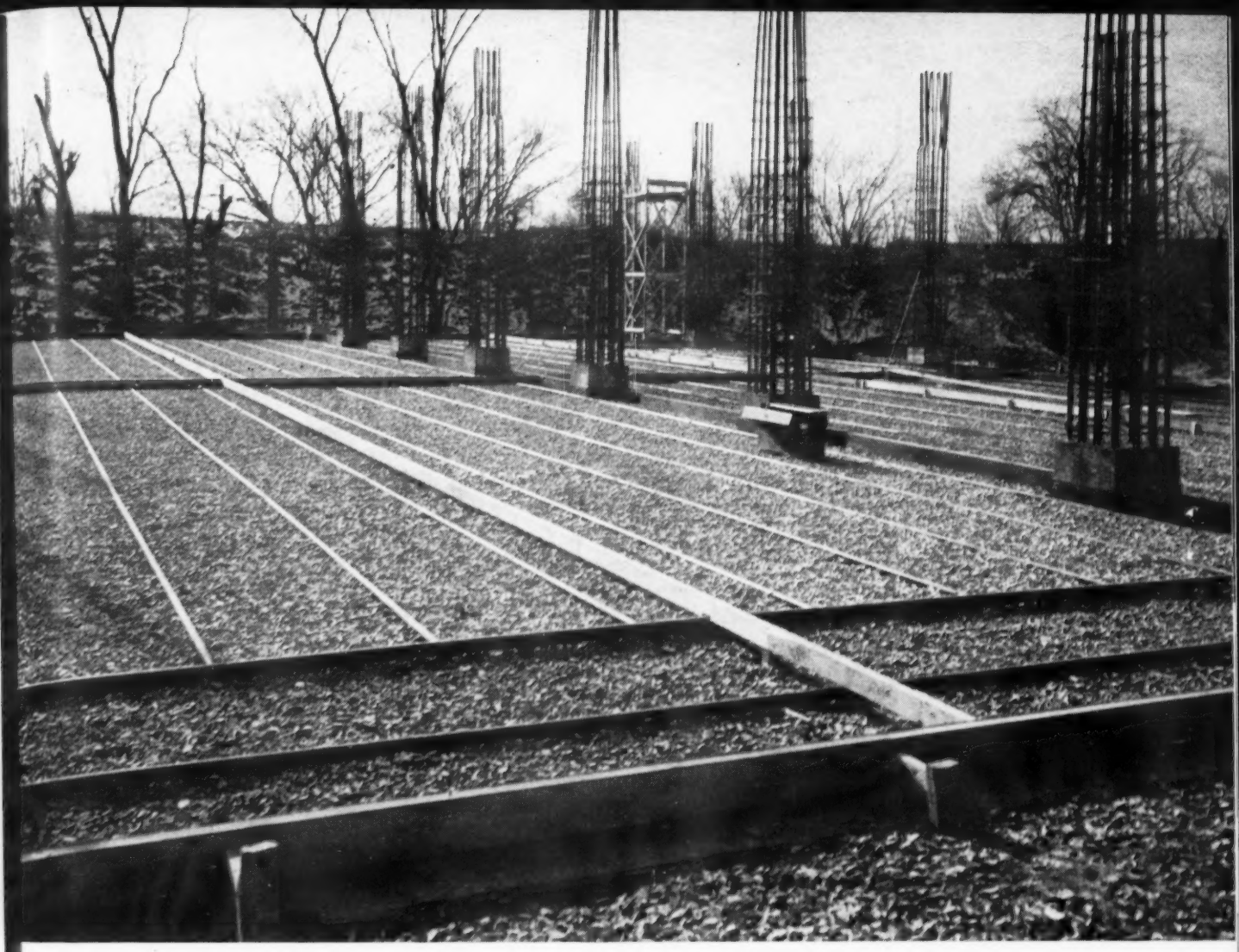
Conclusion. The municipally owned utility is an integral department under the City Commission of the City of Jacksonville as to executive and administrative authority. George A Pierce, commissioner of public utilities, is directly responsible for executing contemplated enlargements and improvements. Robert B Cowan, engineer-manager for the city, is in direct charge of the operation and maintenance of the city water and electrical utilities, reporting directly to Mr Pierce and the city commission.

Reynolds, Smith and Hills, of Jacksonville, is responsible for engineering recommendations, reports, studies and design of the new facilities.

Jacksonville Load History

Year	Annual consumption, kwhr	†Peak demand, kw
1920	30,756,000	.....
1925	60,731,100	.....
1930	88,556,700	22,400
1931	90,491,100	22,400
1932	87,273,300	22,400
1933	87,179,700	22,800
1934	96,203,600	24,800
1935	103,750,200	25,500
1936	117,319,000	30,900
1937	134,730,300	31,800
1938	138,415,000	34,100
1939	159,286,700	38,000
1940	176,531,600	42,500
1941	213,585,700	52,000
1942	242,443,600	53,000
1943	318,975,480	73,000
1944	360,956,100	75,000
1945	367,406,500	76,000
1946	364,227,700	85,000
1947*	419,166,000	91,000
1948*	448,074,000	97,000
1950*	510,708,000	109,000
1955*	655,248,000	138,500
1960*	794,970,000	168,500

*Predicted



1 Similar to a radiant-heating installation, the wrought-iron pipe grid lies on a crushed stone foundation. After connections are welded and tested the concrete slab is poured. This serves as foundation for the insulation and room floor

Freezing-Room Floors Need Heat

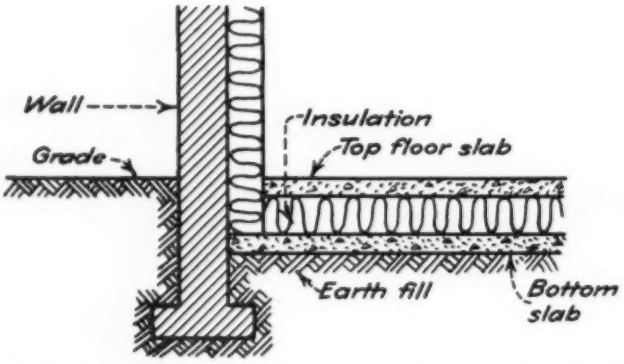
If you are planning to erect a low-temperature freezing or storage room, ward off trouble by following these pointers on floor construction. They will keep down expensive repairs

By A W RUFF
V C Patterson & Associates, Inc., York, Pennsylvania

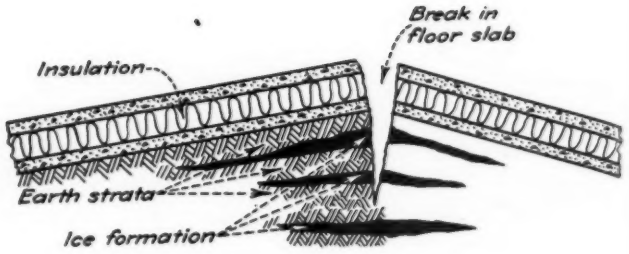
▶FLOOR CONSTRUCTION for refrigerated rooms maintained at temperatures of zero F and lower must receive special engineering attention when built directly on the ground. Experience proves that ice forming in the earth under the floor will eventually buckle the concrete slab. This is particularly true of large rooms, and where floors are at grade level or below. Gradual ice accumulation in the ground sets up a force that usually raises and eventually ruptures the floor slab. One preventive is to install the heating coils as in Fig. 1.

The Problem. Usual design of insulated floor consists of two concrete slabs separated by insulation, Fig. 2. Layers of ice form in the earth that have a highly destructive effect, Fig. 3. It often takes several years for enough to accumulate to cause visible damage. Cases have been observed where the floors buckled up 12 in. A few inches, however, is usually serious enough to put a room out of service. The complete floor must then be torn up, expensive cork insulation thrown away, and the floor completely relaid. This operation may cost as high as $4 per sq ft of area.

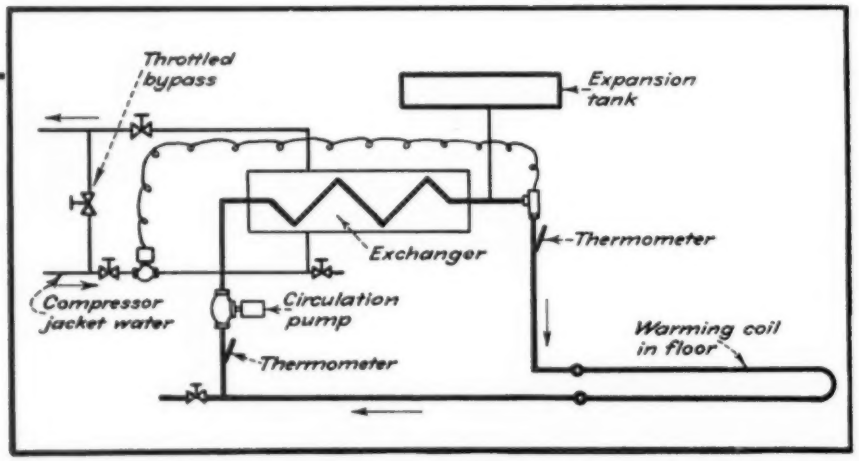
Why Ice Forms. When a room is refrigerated, temperature drop through the insulated walls and floor must be equal to the difference between inside and outside temperature. At the floor, the surface temperature of the earth or fill against the underside of the bottom concrete slab, will vary with the heat conductivity of the ground,



2 The usual design of freezing-room floor consists of two concrete slabs separated by a thick layer of insulation



3 Freezing temperature in the ground causes ice to form in the solid layers that raise and rupture floor slabs



6 Flow diagram of heating system explains how temperature is controlled automatically. If compressor jacket water is the heating medium use a bypass line

7 Heat exchanger, control valves, expansion tank, circulating pump and connecting pipe can be mounted outside freezing room on a wall above other machinery

other factors being equal. The earth, usually a fairly good insulator, resists the flow of heat from lower elevations to balance the heat lost upward through the room's floor insulation.

Consequently, in time, the earth gradually chills and finally reaches freezing temperature adjacent to the floor. But the better the floor insulation, the slower the chilling action on the earth. For this reason, insulating engineers usually specify 8 in. of cork for zero-F rooms and 10 in. or even 12 in. for lower temperatures.

Seasonal Effect. Because soil temperature and moisture content influence ice formation, the seasons probably govern effective ice buildup. This may account for the strata formation of almost clear ice between thin layers of earth. Experience indicates that ice once formed does not melt unless the floor is warmed up for some time.

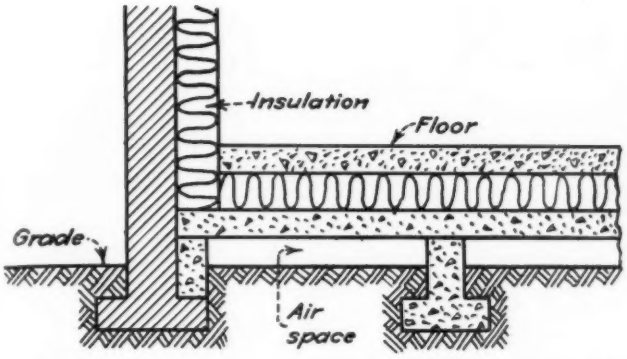
In one instance the floor had buckled under a —30 F freezing tunnel. Steam heat was applied, through double-wall pipes driven under the slab, for several weeks before the ice melted and the earth dried enough to allow the floor to settle into position.

Method of Corrrection. Permanent solution to the problem is neither thicker insulation nor drainage, although both will delay floor failure. A method must be used that keeps the earth contact temperature above freezing (32 F).

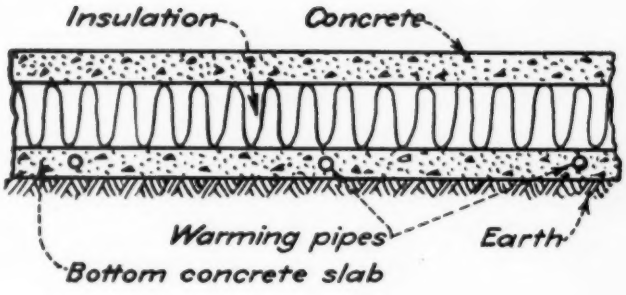
Three methods have been successful:

1. Lay electrical-heating cable in the earth under the concrete slab and, by thermostatic control, keep the earth above freezing. This is usually uneconomical because of the power cost.

2. Raise floor level to provide space



4 Where a high floor is not objectionable, space underneath permits summer air circulation to warm the floor



5 Warming pipes imbedded in lower slab add enough heat to keep ice from forming in the ground under the concrete

for air ducts, Fig. 4. Air circulating by convection warms the concrete slab during summer and prevents destructive ice accumulation. This method is objectionable because of the higher floor and extra construction costs.

3. Install a pipe-warming coil in the bottom concrete slab, as in Fig. 1 and 5 where the ¾-in. wrought-iron pipes are in place. By circulating a nonfreeze solution warmed to about 45 F, the earth temperature can be held at 40 F, thus positively preventing ice formation. Construction photograph, Fig. 1, shows the warming pipes in location before pouring the bottom concrete slab.

The fluid-warming circuit consists of a heater, circulating pump and automatic temperature controls, Fig. 6 and 7. Because of cost the fluid, selected for the ice-cream plant of Penn Dairies Inc, Lancaster, Pa., is No. 2 fuel oil although radiator nonfreeze solutions or transformer oil could be used.

Jacket water from refrigerating machines is also suitable as a source of heat for the exchangers. This water is usually either thrown away or cooled for reuse, so extracting its heat for earth warming may reduce operating expenses.

Floor-insulation cost is another economy of major importance that can be taken advantage of. With a pipe-warming system, 6 in. of corkboard is justifiable on zero-F floors instead of 8-in., or more which is normally called for.

Refrigeration loss through 6 in. of cork in the floor is so small that a thicker layer is not economically justified. Saving in insulating costs is usually more than sufficient to pay for a pipe-warming system, besides assuring a troublefree insulated floor.

Temperatures observed on a new installation of a −10 F room were:

Time	*Earth temp*
July (started)	60 F
August	50 F
September	40 F
October	Heating started
December	42 F

8 Heat flow up through the floor depends on the temperature drop across the insulation. Careful design adds enough heat to keep the ground from freezing, yet does not increase the temperature differential beyond a safe, economical point

SPEAKING OF POWER

In publishing, odd things keep popping up, like the business-reply card from one of our Readers Service pages (similar to page 176A in this issue) which recently came in from Italy. In proper form, the writer requested manufacturers' literature reviewed in the same issue. All very normal except for the date—the card was from the July 1939 issue!

We'd give a lot to know how many hands that copy of POWER passed through and where it went during the tempestuous years in Italy since 1939. We'll never learn, but of course we're honoring the card—assembling for the writer current literature similar to that reviewed in that issue of long ago.

★ ★ ★

Speaking of turbines, the backlog of orders on industrial units (7500 kw and under) is beginning to disappear while the orders for central-station units continue to pile up. If you're thinking of expanding or modernizing industrial-power facilities, don't let the published and quoted deliveries on the big units discourage you—the time's as good as it is ever likely to be to put an industrial-turbine order on the books.

★ ★ ★

THE CHECKER

Oh the Checker's life is the life for me,
Unrestricted and full and free.
Few are my tools and brief my creed,
One red pencil is all I need.
One big pencil and one fond dream,
To drive that draftsman off the beam.
This is my method, and this I do:
Find one error, then follow through.

Find an arrowhead out of place,
Add a rivet and change the space.
Now, lest the Field misunderstand,
Make the assembly opposite hand.
Double the scale if the detail's small,
Let's be thorough and change it all.
Uninhibited, wild and free—
The Checker's life is the life for me.

These are the days of blood and steel,
But in my heart is a high ideal.
This is my ultimate aim and goal
For which I freely would pledge my soul.
Some time, somewhere may the chance be mine,
To change the border and center line,
To check all day, and along toward night
Return a print that has NOTHING right!

—R S Clark

Our good friend E A Roberts writes from Carlsbad, New Mexico, to tell of one Oscar Dubuque, who operated a small 300-kw hydro plant for the city. About 100 yards from the plant and six miles from town, Oscar lived with a cow, some chickens, and a little garden for which he had all the irrigation water he wanted. The plant just about ran itself, and in the doorway, tipped back in a chair, sat Oscar.

Right at his side he kept a 30-40 Krag rifle. It was sort of company and could be used to keep off stray coyotes, hawks or drunken cowboys. One night just before dusk when the load was building up, a big hawk sailed into the chicken yard and picked out a fat pullet that dawdled outside. The hawk flew over to a pole about two spans from the plant and settled on the crossarm to eat. That line was built of four bare wires three 12,470-volt phase lines and a grounded neutral for 4-wire 7200-volt service.

Mad as all get out, Oscar grabbed his Krag and shot quickly. All would have been well if he hadn't been a good shot; a lesser marksman would have missed the whole works. Heading dead for the hawk, the bullet cut the neutral, the heavy wire whipped back in an arc that touched all wires, and the hawk took off in what looked like a photographer's flashlight, scared, but still hungry. Oscar wasn't exactly what you'd call scared—he was petrified. Juice off, phone and transmission lines burned down, and no help near. It turned out to be quite a job of fixing, and a lot of linemen as well as the hawk were hungry late that night.

★ ★ ★

Through the changing fortunes of war and peace, Americans have always felt a warm spot in their hearts for the Finns—distinguished by their determination to pay their just debts of World War I and by their equally determined efforts to pay indemnities of World War II and to reconstruct their nation. These demands on industrial activity have created unprecedented needs for graduate engineers and architects—needs which the country's sole institute of technology (Teknillinen Korkealou) is struggling to fulfill.

During the war, President Martti Levón writes, the institute was twice severely bombed. The second bombing completely destroyed the library of about 80,000 volumes. Through purchases and donations about 40,000 volumes have been restored, but problems of securing foreign funds make acquisition of technical literature and periodicals extremely difficult. Dr A E Morgan, of the American Friends Service Committee, is helping to call this need to the attention of engineers in this country. If you have technical books or magazines you can spare, mark them for the Institute of Technology, Helsinki, and send them to the Legation of Finland, 2144 Wyoming Ave, N W, Washington, D. C. Dr K T Jutila, the Finnish Minister, will arrange for shipping to Finland.

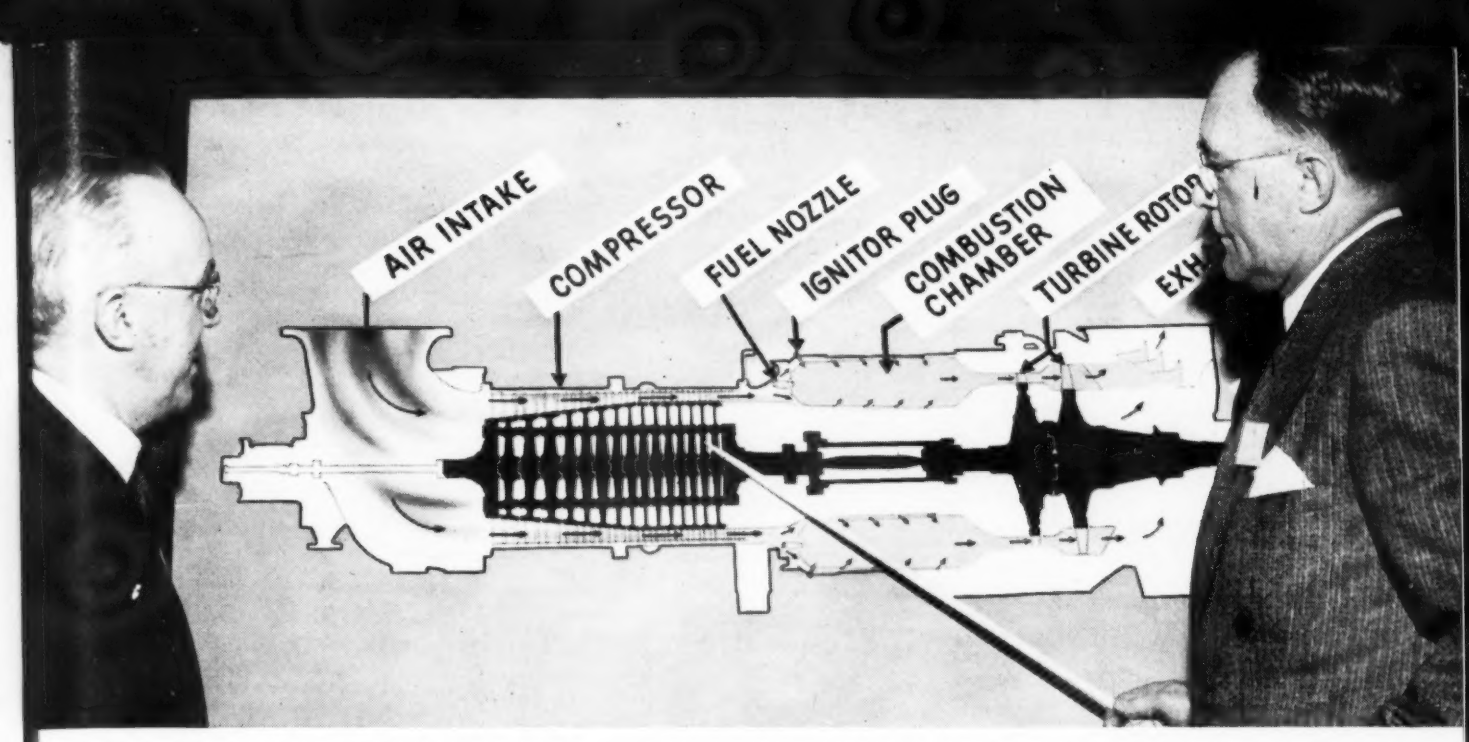
★ ★ ★

What will undoubtedly be the first gas turbine to operate on a U. S. utility system has been ordered from General Electric by Oklahoma Gas and Electric Co for installation in its Huey Station at Oklahoma City. Expected to be in operation by the summer of 1949, this 4000-kw 6700-rpm gas-fired unit (p 95) will drive a 3600-rpm generator feeding the transmission system. Heat in the turbine exhaust gas will be recovered to supplement existing feedwater-heating facilities, increasing net output of the station's steam turbines. The combined effect will be to increase the net capacity of the station by about 5000 to 7000 kw, depending on ambient air temperature.

THIS MONTH'S COVER

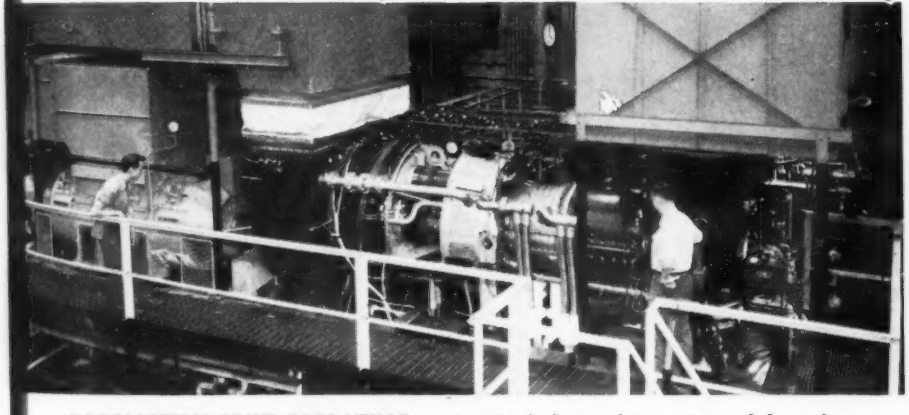
To those who think of water as something to drink, or perhaps to wash in, its importance as a cooling medium is hard to realize. Somewhere back in the dim past an inquiring soul tumbled to the fact that a given amount of water would do many times as much cooling work if allowed to evaporate. Modern cooling towers, such as these giants at Rupperts Brewery in New York, apply the evaporative cooling principle with high effectiveness, conserve water and, since water always costs something, if only pumping charges, save money.

By the way, that dramatic diesel on the April cover was the work of Theodore Van Gorp, McGraw-Hill artist previously mentioned in "This Month's Cover" for February.



GAS-TURBINE PLANT reviewed by R B McColl, pres, American Locomotive Co and C E Wilson, pres, General Electric Co

4800-Hp Gas Turbine on Trial Runs



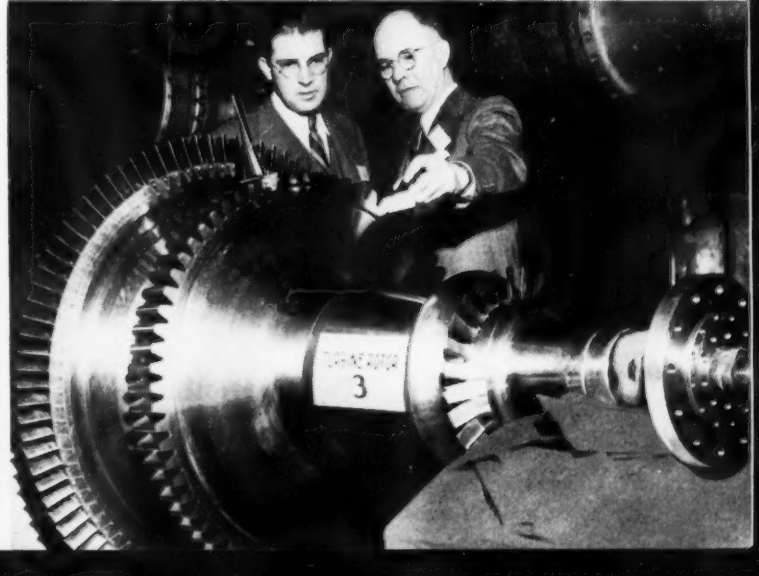
LOCOMOTIVE UNIT OPERATING on test bed shows, l to r, two of four dc generators, exhaust duct, turbine, combustion chambers, compressor, air inlet, controls

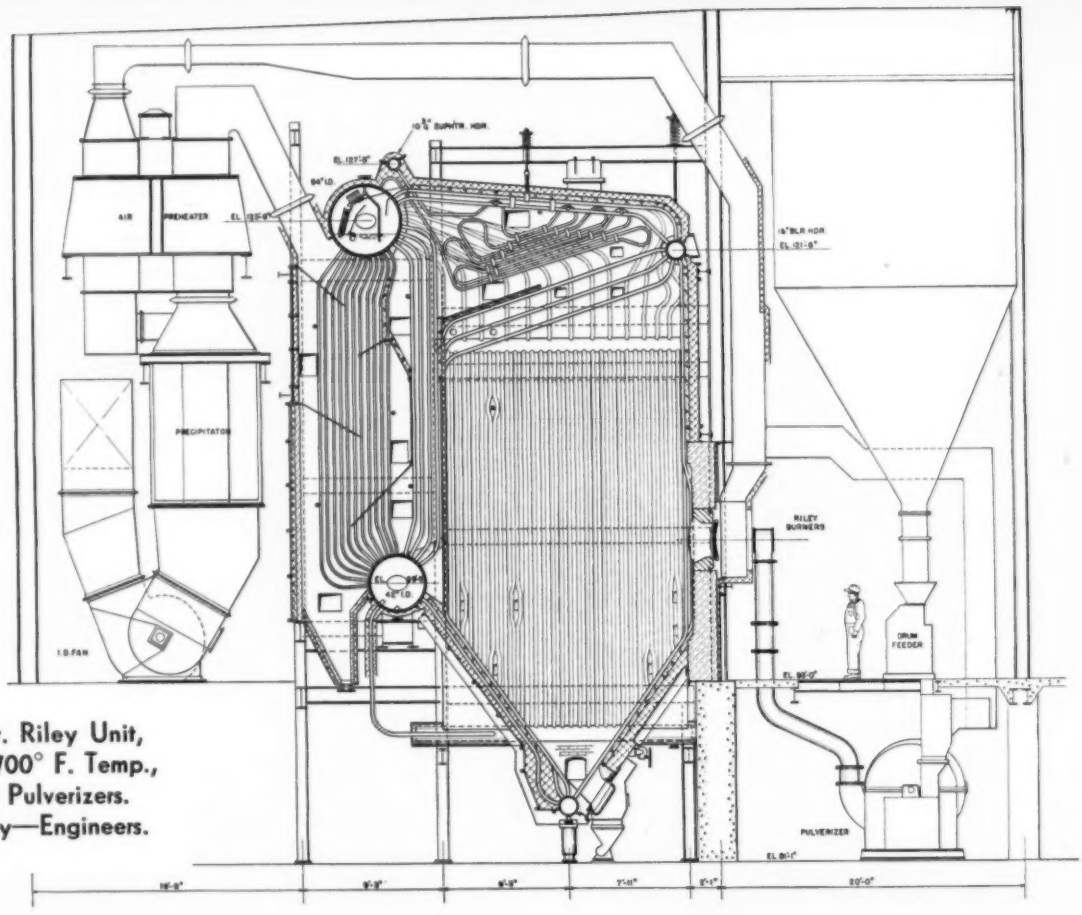
▶ THE LATEST GAS TURBINE to be shown in the flesh is the General Electric 4800-hp unit designed for locomotive application. It was unveiled at a meeting of the Railroad Executives Conference in Schenectady, New York. The unit, previously described in POWER, August 1947, pp 68-70, has been under test since September 1947. Design predictions for the 1400-F 6700-rpm unit are being realized; the over-all thermal efficiency of the plant exceeds 17%, based on the lower heating value of bunker-C oil.

(*Continued on page* 98)

PART OF TEST BOARD setup used to determine gas turbine performance; for normal operation only gray panels are needed

TURBINE ROTOR ASSEMBLY is discussed by Ben Skrotzki, associate editor, POWER, and L R Lee, G-E gas turbine engineer





100,000 lbs/hr. Riley Unit,
700 lbs. Press., 700° F. Temp.,
fired by Riley Pulverizers.
Sargent & Lundy—Engineers.

Riley Unit at Northern Paper Mills operating at 88.8% efficiency...

The new 100,000 lbs/hr Riley Steam Generating Unit, fired by Riley pulverizers, recently installed by Northern Paper Mills, is producing steam at efficiencies of over 88%, well above guaranteed performance. The unit has also been operated at more than 30% overloads. Here is another plant where actual reports far exceed Riley's guaranteed performance.

If you install complete Riley Steam Generating Units you likewise are assured of obtaining equally outstanding results and low steam costs. Riley users will tell you so and that you can rely on Riley.

Northern Paper Mills installed their first Riley units in 1938. Like so many companies, after they once install Riley units, they are so well satisfied that they invariably come back for more Riley units when additional steam capacity is required.

HEAT BALANCE

Losses due to—	
Moisture in Fuel	.40%
Hydrogen	3.33%
Moisture In Air	.12%
Dry Chimney Gas	5.21%
Comb. in Refuse	1.43%
Rad. Unacct.	.65%
Total Losses	11.14%
Efficiency	88.86%

TRADE MARK Rx REGISTERED — CONTINUOUS SOLVENT EXTRACTED CRUDE

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul
Pittsburgh Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Tulsa

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

NORTHERN PAPER MILLS

GREEN BAY, WISCONSIN

November 5,1947

L.V.Andrews,Chief Oper.Engr.
Riley Stoker Corp.
Worcester,Mass.

Dear Mr.Andrews

Thank you for your letter under date of Nov.3rd and accompanying test report which I find very interesting. I have asked Sargent & Lundy to check the report and if in order to certify your final bill for payment.

I am quite sure this will be taken care of very promptly and a check will be forthcoming.

It is needless to say we are very happy, indeed, with our #3 boiler installation and appreciate especially the very fine service you gave us on the delivery of the boiler and its installation.

Yours very truly,

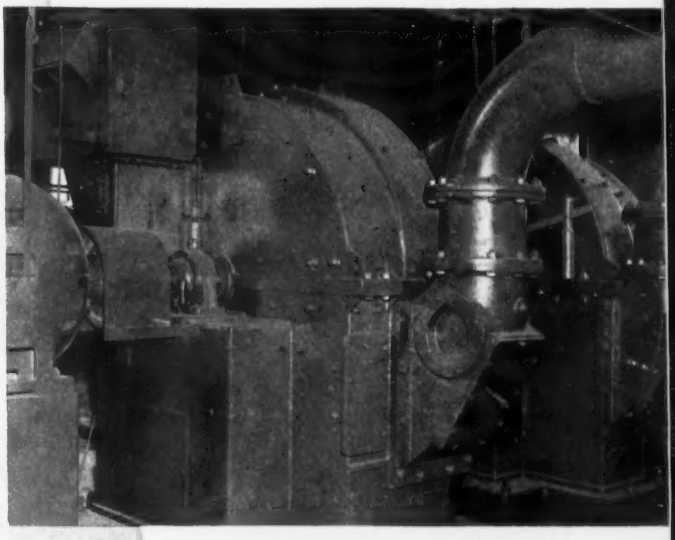
NORTHERN PAPER MILLS

H. W. Gochnauer

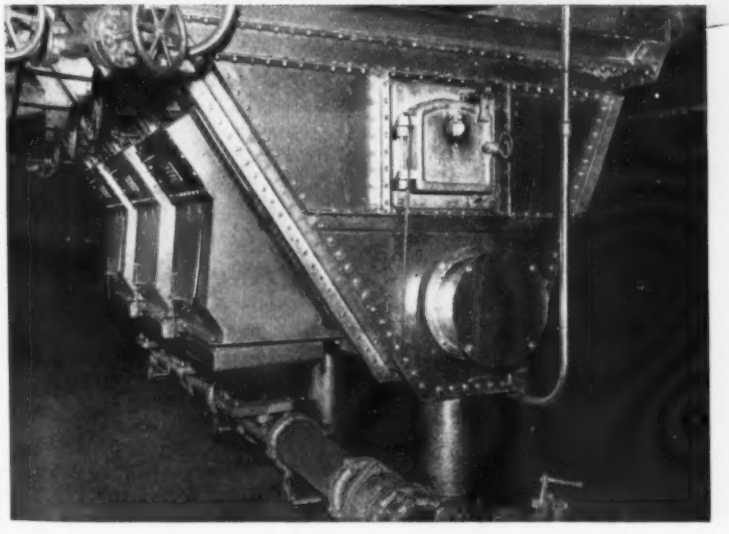
Chief Engineer

H.W.Gochnauer:L

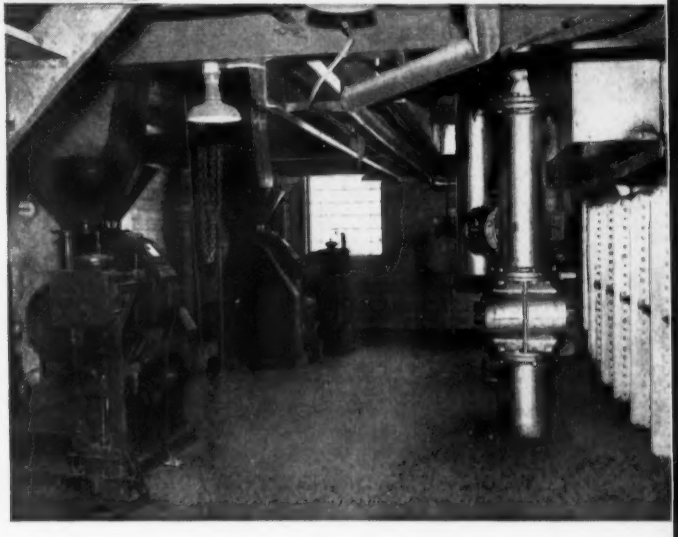
Mr. H. W. Gochnauer, Chief Engineer, Northern Paper Mills says: "Needless to say, we are very happy indeed with our No. 3 boiler installation . . ."



Two Riley Pulverizers fire the new Riley unit at Northern Paper Mills



Single-header, Water-cooled Hopper Bottom provides easy ash removal



Pulverizer Feeders are located on the operating floor

A survey of your Power Plant by a consulting engineer will possibly show ways of making suprisingly large savings in your power costs

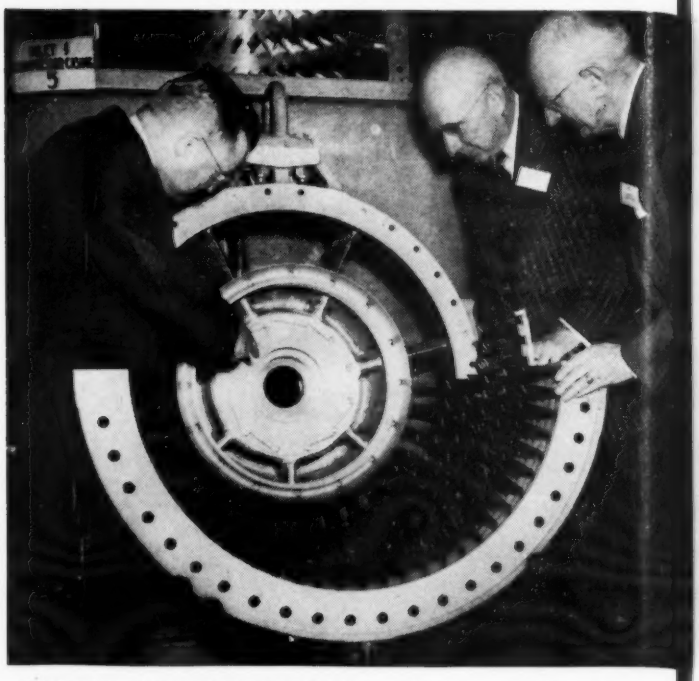
COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

NEWEST GAS TURBINE (Continued)

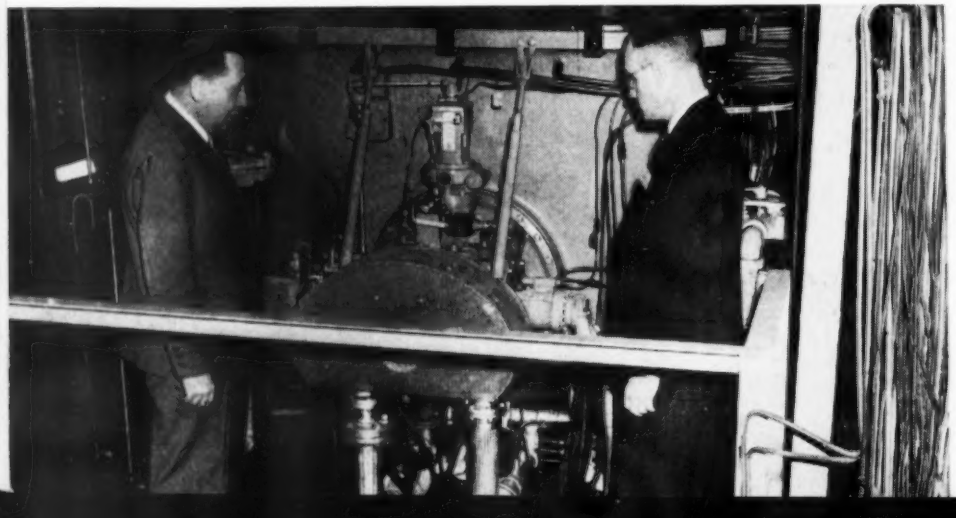
ACCESSORY GEAR BOX being assembled on shaft at compressor inlet end contains governor, fuel pump, oil pump, other items.



FORWARD END OF COMPRESSOR casings is scrutinized by G W Wilson, G-E Co, R E Woodruff, A W Munster, rail "execs"

COMPRESSOR ROTOR CONSTRUCTION, described by A J Dargis, G-E Co, is made up of individual wheels (right foreground) for 15 stages, bolted together rigidly

TEST CONNECTIONS AND SHAFT AUXILIARIES are inspected by E S Gunn, General Electric Co, and P G Hatch of the New York, New Haven and Hartford Railroad



An auxiliary diesel engine starts the gas turbine from cold shutdown condition. Two spark plugs light-off the diesel fuel in all six combustion chambers through cross-ignition tubes. When reaching idling speed, bunker-C oil, the main running fuel, displaces the diesel fuel, and the starting mechanism, including spark plugs, automatically cuts out.

At fuil speed, the 15-stage axial-flow compressor takes in 80,000 cfm of air delivering it at 6 atmospheres' pressure to the combustion chambers. The turbine drives the compressor and delivers 4500 hp through a reduction gear to four d-c generators.

An elaborate test setup provides for taking more than 400 measurements to determine not only the performance of the over-all plant but also the functioning of the individual elements. In this way required modifications and improvements can be made immediately, and new methods and processes may be tried on a day-to-day basis.

On March 1, 1948 the unit accumulated over 300 hours "hot" operating time, more than half on bunker-C fuel. To date no evident need for making changes in basic design has appeared.

Only a Prosperous America Can Be Free

DURING May 50 million American workers will get from the Congress of the United States a real incentive to work.

This incentive is called a tax cut. Beginning May 1, the withholding tax on incomes will be reduced, giving everyone a much-needed increase in take-home pay.

But the tax cut will have a far more important effect. It may be literally a life-saver for American employment and production—and, hence, for the stability of the world. It will help to do two things which must be done if our economy is to continue to furnish good jobs and good earnings.

1. *It will generate part of the private funds for investment in common stocks—the "risk capital" which we need to sustain prosperity.*

2. *It will provide part of the incentives necessary to make American business management still more effective.*

These two predictions are not advanced as matters of opinion. They are based on facts reported by McGraw-Hill field editors.

These facts show why the reductions in upper bracket income tax rates are most significant for our continued prosperity. For the first time in more than twenty years the tax burden on people who can afford to risk their savings has been lightened. To find out what this will mean to the economy, McGraw-Hill field editors all over the nation asked a group of business executives making $15,000 a year or more how they will use the money which the tax cut gives them. Here is what they said:

1. They plan to save—not spend—three-fourths of the money they keep as a result of tax reduction.

2. They plan to invest one-half of these savings in common stocks. If all persons making over $15,000 follow this pattern, they will make available about a half billion dollars of risk capital for American industry.

WHAT THE TAX CUT WILL DO

What will upper bracket taxpayers do with their tax savings?
What can business expect as a result?

TO ANSWER THESE QUESTIONS, McGraw-Hill field editors interviewed a carefully selected sample of business executives earning $15,000 a year or more. Here, for the first time, are solid facts that show how tax reduction will effect the supply of risk capital and business incentives. These are the results:

1) How much of your tax reduction will you save? **74%**

2) How much of your tax savings will you invest in common stocks? **52%**

3) Will lower taxes lead you to switch some of your investment in bonds to stocks? **Yes 28%**

4) Have you passed up an opportunity to invest in a new business in the last five years because the return after taxes did not justify the risk? **Yes 40%**

5) Will lower taxes make you more inclined to take a risk on a new business? **Yes 80%**

6) Have you turned down the opportunity to take a bigger job in the last five years because taxes would take too much of the additional income offered? **Yes 13%**

7) Do you know of actual cases of executives who have turned down bigger jobs or more work because of taxes? **Yes 38%**

8) Will lower taxes make you more inclined to take on a bigger job or more work? **Yes 59%**

3. They also will switch some of their present savings from bonds and bank accounts to common stocks. This might easily add a billion dollars or more to the supply of risk capital.

The one-half billion dollars of tax savings and the funds switched from other investments into common stocks is not enough to end the shortage of risk capital. But it is a start.

Before passage of the tax law, risk capital had been growing increasingly scarce.

One measure of the scarcity is that last year only four-tenths of 1% of national income went into new common stocks. In 1925, a year of normal prosperity, almost 3% of national income was invested in new common stocks.

Another measure is that between 1940 and 1947 people actually reduced their holdings of corporate stocks and bonds by nearly a billion dollars. During the same period, people salted away almost $150 billion in such safe havens as cash, bank deposits, and government bonds.

This drought of risk capital hit us just when we need a vastly increased flow of risk capital to finance the expansion and improvement of our American productive machine. We need risk capital to search for new oil fields and to build new pipelines and refineries. We need capital to expand our over-loaded electric and gas utilities. We need it to finish re-equipping our airlines and railroads and bus lines. We need it to modernize our textile production. We need it to keep pace in the magical, booming chemical industries. We need it to launch the new industry of television.

We need capital for all this work and for much more besides. And we must do all this work if we are to keep the United States dynamic and if we are to create new and better jobs.

The tax cut comes just in time. As the last editorial in this series showed, the flow of risk capital must double or triple if we are to avoid a cutback in industrial expansion next year. A major reduction in industrial expansion because of a shortage of risk capital would menace our prosperity. Whenever capital expansion has sagged, the whole economy has sagged. That is the record. That is why every American has a crucial interest in breaking the shortage of risk capital.

The tax reduction now going into effect helps relieve that shortage. In my opinion, we need still other tax changes to assure enough risk capital for healthy industry and healthy employment.

We should encourage the rapid depreciation and replacement of plants and equipment to keep America efficient.

We should eliminate the double taxation of stockholders' incomes.

We should permit full averaging of good years and bad in calculating income tax payments.

We should cut tax rates again as soon as we can.

The tax cut of 1948 will prime the flow of capital. We must keep it flowing.

The tax cut also encourages our successful men and women to work harder and more effectively.

The McGraw-Hill editors collected some solid facts to show how seriously heavy taxes have discouraged business leaders. Here they are:

1. One out of seven persons the editors questioned said that they had turned down positions with greater responsibilities because heavy taxes would take most of the greater pay that went with the harder job.

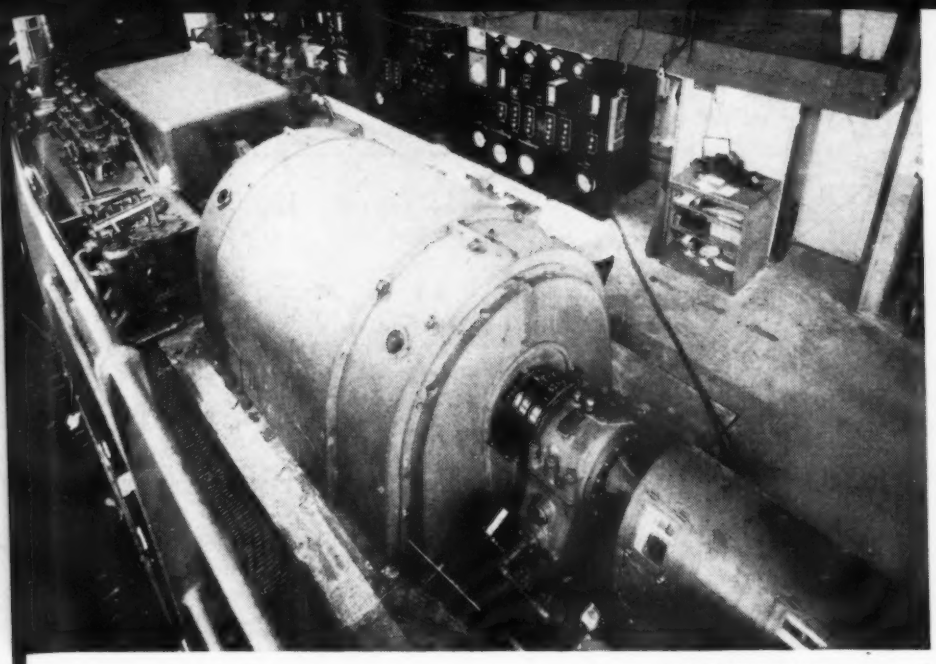
2. Six out of ten executives would be more inclined to accept a more responsible job now that taxes will let them keep more of the added pay such a job would bring.

We all have a stake in incentives which make men work harder, especially talented men. The more we each work, the more we all have.

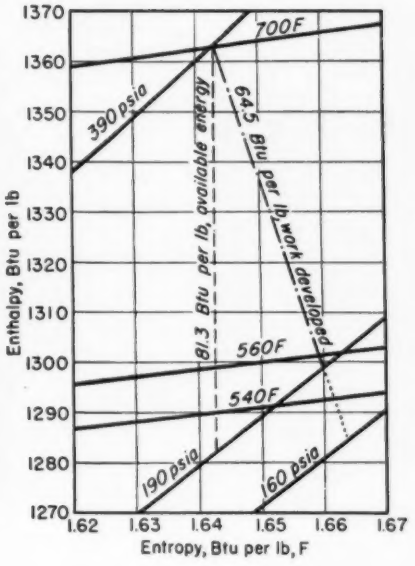
The tax reductions so far made will leave the government more than enough revenue to meet all its expenses, including the proposed defense expenses, and still reduce the national debt. If more defense money becomes necessary, vigorous economy on less essential government expenses will make possible both stronger military defenses and a better tax system. We need both.

Only a prosperous America can be strong enough to remain free—and to help keep the rest of the world free.

President, McGraw-Hill Publishing Company, Inc.



7500-KW UNIT, has turbine, left, fitted with two steam chests, eight governor valves; operates between 375 and 175 psig



MOLLIER CHART shows only about 64.5 Btu per lb of steam convertible to work

NEW YORK STEAM CORP system is divided into uptown and downtown districts. East River Station, formerly tied to southern end of uptown area by 14th St main only, will have added tie through 1st Av main, (dotted). Shaded area is Stuyvesant Town and Peter Cooper housing developments (near East River Station) which district steam will serve

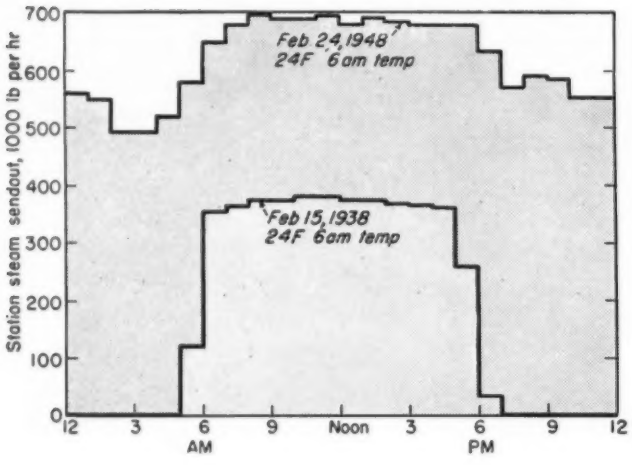
District Steam Supply Makes Byproduct Energy

Steam demands on the New York Steam Corporation system make it possible to generate additional electricity economically. Here's how it's done with backpressure turbine at East River Station of Consolidated Edison Company of New York, Inc

By M J STEINBERG, *Division Engineer, System Engineering Department Consolidated Edison Co of New York*

► STUDIES MADE IN 1934 indicated appreciable fuel economies could be realized by combining electrical power generation and steam supply for district heating. This was one of several factors that influenced installation at the Waterside Station of **"topping"** units that will provide topping capacity of 336,000 kw upon completion of the modernization program.

This installation provides a flexible system for utilizing topping-turbine exhaust steam either in low-pressure con-



EAST RIVER STATION—S UNIT OPERATION

Period	*Service hours*	*Output, kwhr*	*Operating capacity factor, %*
December, 1947*.....	361.25	2,590,000	94.8
January, 1948.....	645	4,720,000	97.5
February, 1948.....	552.5	4,220,000	101.8
March, 1948.....	628.25	4,760,000	101.0

* Unit was placed in service on Dec 16, 1947.

EAST RIVER STEAM SENDOUT, left, for two typical heating-season days reflects increased use of the plant for economy

densing units or as sendout to street steam mains. The diversity in times of occurrence of the steam and electrical peak loads allows using the exhaust steam as capacity for both the steam and electrical peak loads. (See "Consolidated Edison Lays Plans to Complete Waterside Modernization", pp 64-7, August 1946, POWER.)

By operating the steam and electrical systems as a unit, with due regard for loading economy, the maximum over-all efficiency for the combined systems can be obtained.

As a part of the general modernization program, the "S" unit installation at East River Station obtains additional economy from byproduct electrical generation incidental to the delivery of steam sendout. The table on p 101 shows the growth of the steam system and the extent to which it has been economical to supply steam from the Edison electric plants.

System Development. The New York Steam Corporation, largest district-steam supplier in the world, serves an extensive area in Manhattan with steam generated in several sources. The principal stations and the 54 miles of underground steam mains are shown on the map. The system has developed in two areas known as the downtown and uptown districts. A steam main ties the district together and permits a limited supply of steam to the downtown district from uptown plants.

Burling Slip Station supplies the bulk of the downtown district steam, supplemented by a small plant in the basement of the Woolworth Building on Park Place and by customer-leased plants.

Four plants owned by the Steam Corp serve the uptown district. The Edison-owned Ravenswood gas plant in Queens supplies additional firm capacity through a 20-in. steam main tying into the system at East River Drive and East 71st Street. Customer-leased plants also supplement the capacity in the uptown district. The two Edison owned plants, Waterside and East River, serve primarily as a source of economy supply although steam capacity is available on a non-firm basis when not otherwise needed for the electrical system. Steam sendout from the East River Station began in the spring of 1932.

East River Development. With growth of the steam system load, there has been an increase in the economy sendout from East River as shown by the curves for two typical heating season days, at top of this page. At East River, steam pressure drops about 200 psi between boiler and street mains, as on the Mollier chart, top of p 99. Compared to usual turbine practice the amount of energy available per lb of steam is small, but conservative estimates of probable station sendouts showed that a turbine to accommodate a flow of about 500,000 lb per hr would be the most economical size. This led to selecting a 7500-kw turbine-generator.

The map, p 99, shows East River connected to the steam-distribution system through a 24-in. main cutting across Manhattan from east to west. Completion of the Stuyvesant Town and Peter Cooper Village housing development, by the Metropolitan Life Insurance Co, directly adjacent to the station will increase the quantity of steam that can be supplied economically from East River. These projects, partially completed, are supplied through an additional 24-in. main, which is being extended up First Ave to connect to Kip's Bay before the end of this year.

This main will ultimately increase East River sendout capacity to about 900,000 lb per hr and permit greater flexibility in the loading of the three major stations supplying the uptown district. It will also provide extension of service to prospective consumers a reasonable distance from the main.

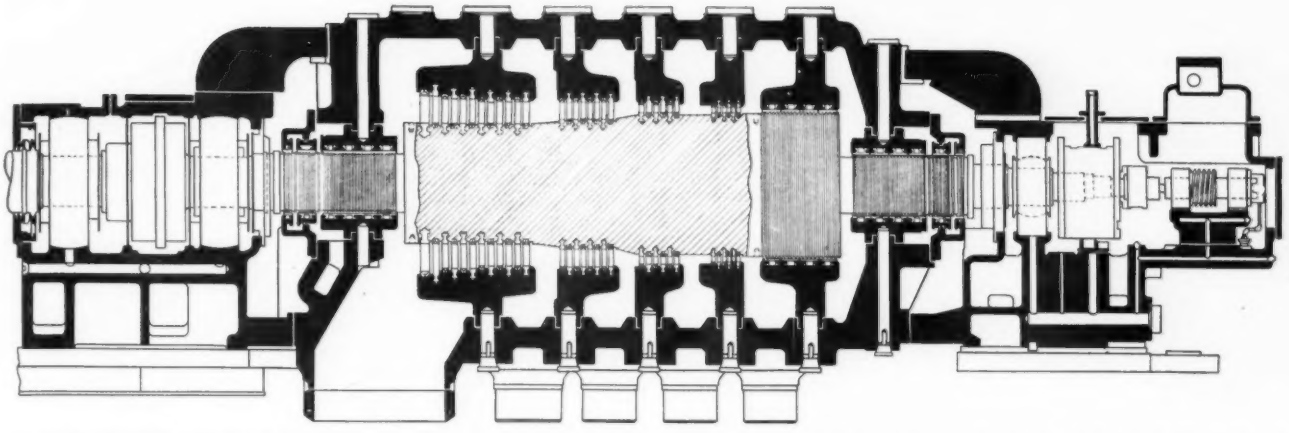
The S Unit. The new unit at East River was placed in operation December 16, 1947. Since then it has operated at practically maximum output. Outages have been limited to adjustments usually needed for initial operation to reap maximum benefit from its byproduct generation.

The unit consists of a 7500-kw 3600-rpm turbine driving a 3-phase 60-cycle 13.8-kv 0.8-pf generator. Turbine-throttle steam conditions are 375 psig and 700 F exhausting to pressures varying from 140 to 180 psig. Allis-Chalmers Manufacturing Co built the unit. Turbine performance depends markedly on the backpressure for this

New York Steam Corp Station Sendout Capacity

Station	*Lb per hour*
Kip's Bay.....	2,070,000
Burling Slip.....	1,550,000
59th Street.....	165,000
60th Street.....	340,000
66th Street.....	255,000
Park Place.....	125,000
Ravenswood.....	620,000
Leased plants.....	2,767,000
Total.....	7,892,000
Waterside.....	2,300,000*
East River.....	

*Available when not required for electrical production.



BACKPRESSURE TURBINE OF 7500-KW unit has 16 reaction stages, four steam-admission belts, four governor-controlled valves on each of two steam chests. Glands at both ends of turbine shaft are combined labyrinth and carbon-ring type

short expansion range as shown by the flow chart, below. Exhaust steam must be desuperheated before delivery to the street.

The high-pressure cylinder and exhaust end comprise the turbine casing, both being split horizontally. Steam from the two steam chests enters the turbine's four steam belts through flexible piping connected to both upper and lower halves of the casing, see the cross section above. Each steam chest has four governor-controlled valves regulating steam admission into the 16-stage reaction-bladed turbine.

Being bolted solidly at the low-pressure end, the turbine casing expands toward the high-pressure or thrust end. Flexibility of the webs supporting the thrust end permits free expansion of the turbine cylinder.

The labyrinth seals on each end of the shaft are made up of several rows of radial spring-backed labyrinth strips having several sealing edges. A leakoff at about 10-psig pressure between the labyrinth and carbon rings vents to the station auxiliary exhaust header. A leakoff at slightly less than atmospheric pressure between the two outside rows of each gland prevents steam leakage into the turbine room. An eductor withdraws the steam from these points.

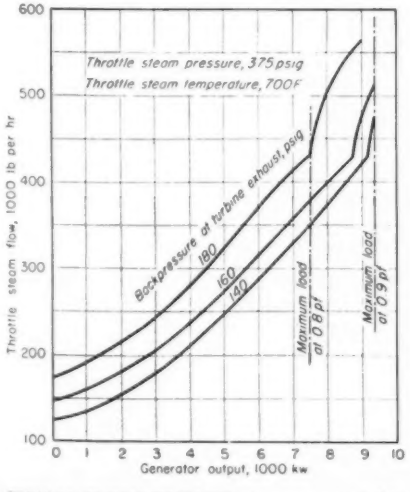
Governing. Each of the two steam chests has a throttle valve of the single-seat balanced type with built-in pilot valve that trips on overspeed or by manual operation. Each steam-admission valve, built as a separate assembly and spring loaded, opens and closes by cam action. An operating mechanism connects the cams to the power cylinders.

A standard Allis-Chalmers governor gear operates a power oil relay, which in turn controls the power cylinders. A flyball-type overspeed governor operates mechanically the throttle-valve tripping mechanism.

Normally the backpressure regulator controls the turbine-steam exhaust pressure to match the sendout requirements, varying the electrical output to suit, and the regular turbine-speed governor supervises the overspeed control. A backpressure regulator opens the steam-inlet valves on a drop in system pressure. In an abnormal drop, such as a main break, the load-limit regulator functions to adjust the inlet valves and prevent an overload on the unit.

Generator. A 45-kw 250-v main exciter and 3.5-kw 250-v pilot exciter serve the generator on this unit. The unit is air-cooled by a closed system using a 2-section finned-tube cooler. Fresh makeup water for the main station serves as the cooling medium, discharging to the station storage tanks from the generator air cooler.

Since East River is a 25-cycle station, this 60-cycle unit ties into the Waterside Station bus through a 13.8-kv feeder over a mile long. A pushbutton automatic synchronizer phases the generator to the bus.



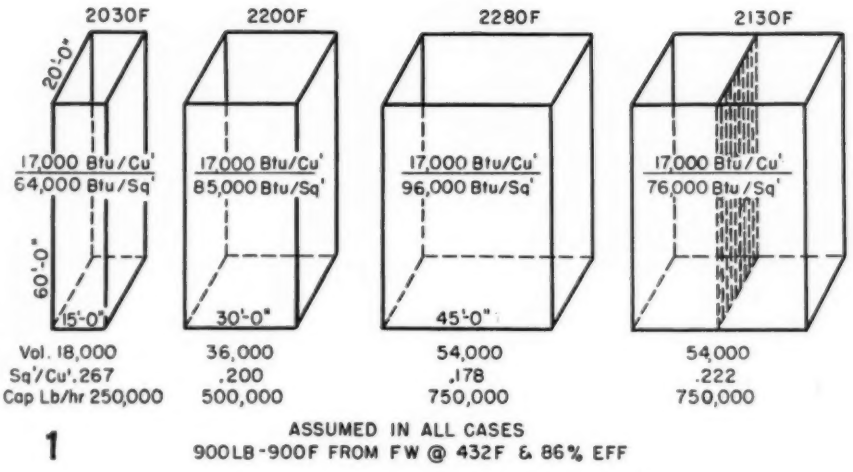
STEAM-FLOW CURVES show appreciable increased output from lower backpressure

NEW YORK STEAM CORPORATION LOAD GROWTH

Year	Total sendout, million lb	Sendout from Edison plants: Million lb	Sendout from Edison plants: % of total	Peak sendout rate, lb per hr
1925.....	6,060	.....	....	1,762,000
1930.....	12,916	707	5.5	4,728,000
1935.....	14,755	1,046	7.1	5,773,000
1940.....	14,095	1,915	13.6	4,849,000
1945.....	17,903	7,845	43.8	7,432,000
1947.....	18,272	8,974	49.1	6,966,000

Note: All-time peak sendout of 7,781,000 lb per hr occurred between 8 and 9 am on Feb 10, 1948 with 13-F morning temperature.

Why not write specifications, argues N J Connors, sales engineer, Babcock & Wilcox Co, in words that enable comparison? Start with terms that relate heat release to performance; gas temperatures to measurement; ash to firing



1

Make Your Furnace-Design

▶A LARGE NUMBER of specifications that are issued fail to accomplish their objective. So far as furnace designs are concerned, they surely fail if we assume that the objective is to receive bids that are truly comparable.

The furnace-design problem with all its interrelated variables is complex and difficult at best. Probably for this reason engineers who write specifications are somewhat reluctant to tie the designer's hands too tightly. But they usually do take a hand in the problem, at least to the extent of specifying a value of Btu per cu ft that is not to be exceeded. On some occasions they specify, as well, the maximum temperature of gases leaving the furnace. But they don't qualify by stating how the temperature is to be taken. Behind all this is the specification writer's desire to control something.

The furnace-design problem will probably always be a field of some difference of opinion. That is no reason, though, why we should not strive in every way possible to clear up thinking on the subject. At least let's avoid use of terms that tend to further misunderstanding.

Heat Release. What the specification writer tries to control, of course, is the temperature of gases at those points where slagging trouble is first likely to make itself felt. When he does this through the medium of a value of Btu per cu ft, not only is he doing it in a very indirect manner but he also gets no control. Until he further ties this value into a particular kind and extent of wall construction, and knows just how to vary this value for furnaces of different sizes, he has no controlling factor.

Almost every engineer realizes that the bounding surface does not change proportionally with volume. Yet a great number of engineers continue to use Btu per cu ft—a term that disregards this truth. Why is this?

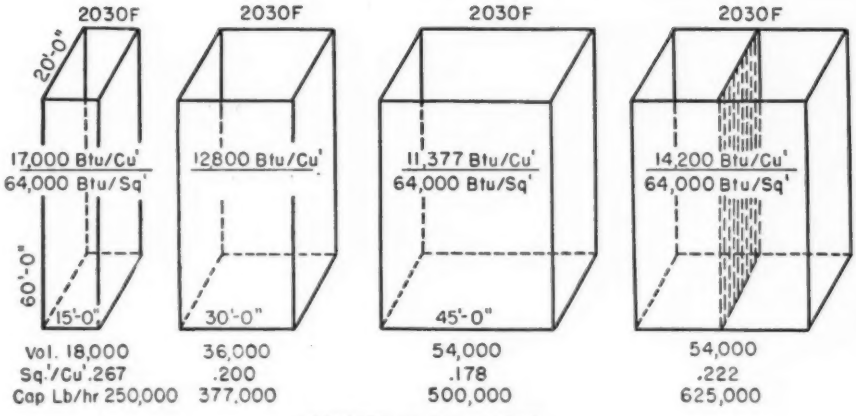
For one thing, habits of thinking on furnace designs have been formed through a long period that knew no better guide. For a second, a large number of engineers do not appreciate the danger of too much reliance on Btu per cu ft as a measure of the furnace-design adequacy. It is surprising how few engineers really know what happens to this measuring stick of Btu per cu ft from size variations alone. Let's simplify the problem to the extent of removing the other variable, namely, degree of waterwall covering, and assume only completely water-cooled surfaces.

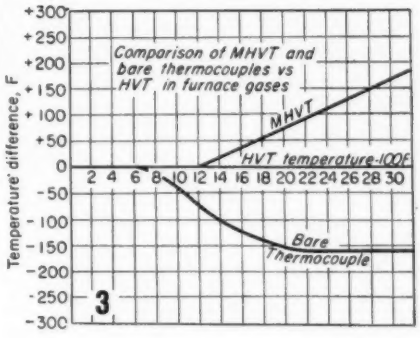
Working Example. To illustrate, take a furnace of cubical shape, having a dimension of 8 ft, 0 in. on all sides, and assumed to be watercooled on all six faces. This is not far from what one might find in marine practice. The volume is 512 cu ft and the envelope area 384 sq ft. If we liberate heat in this furnace at, say, 70,000 Btu per sq ft of watercooled furnace surface per hour, the Btu per cu ft is 52,500 per hour. Now take a furnace of dimensions found in large central-station units, 45 ft, 0 in. x 60 ft, 0 in. x 20 ft, 0 in. Here the volume is 54,000 cu ft and the surface 9,600 sq ft. If we liberate heat in this furnace at the same rate, that is, 70,000 Btu per sq ft per hr, the Btu per cu ft is only 12,500. Yet in each case the same amount of heat is being presented for absorption to each square foot of furnace cooling surface. Does a yardstick that varies like this have much value?

Just one more example to drive home the point. Consider the large furnace in the last example. Without changing the dimensions, let us put a division wall down through the furnace. This wall substantially divides the furnace into halves and receives heat on both sides. Now our surface has changed to 12,000 sq ft, an increase in radiant-heat absorbing surface of more than 30%. If we introduce no more total heat than before, no engineer would have much trouble deciding which of these two furnaces is more effective in reducing gas temperature. But our commonly used yardstick, Btu per cu ft, which is supposed to tell us something about what is happening in a furnace, fails utterly to recognize this drastic change in surface. The Btu per cu ft is exactly the same after adding the division wall as it was before.

Perhaps this Btu-per-cu-ft weakness can be cleared up by closely examining the diagrams above.

In these diagrams are shown four furnaces assumed to be watercooled on all six faces. Each one is dimensioned realistically for a unit of the capacity labeled under each sketch. Also given





Specifications Work for You

is the ratio of surface to volume and the volume itself.

Furnace Sizes. Now let us assume that all these widely varying sizes of furnaces are sized at the same Btu per cu ft. If this is the case and with all of the surfaces operated under one set of conditions as to coal, combustion and ash coating, we know from actual high-velocity thermocouple tests that the leaving temperature of the gases for this set of conditions is as shown above each sketch. It will be seen that these temperatures vary widely even though the Btu per cu ft is always the same.

Now what we really want is to have control of these temperatures. This at least is what we think we are doing in specifying a certain Btu per cu ft. Let's see, in the diagrams above, what happens to these same furnaces and the capacity of the boilers they serve when we really control this exit temperature.

We want to hold this temperature at 2030 F. To do this we have seen from the diagrams on p 102 we cannot present to the furnace surfaces more than 64,000 Btu per sq ft per hr. Notice what this does to the Btu per cu ft value and, worse still, what it does to the capacity we thought we had when we were placing so much reliance on Btu per cu ft in these diagrams.

In conclusion, Btu per cu ft is safe to use only in comparisons of units of approximately the same size. It is very dangerous and misleading to use it over a wide range of sizes. It is dangerous because for many years most of us have been living with the comfortable feeling that our pet value of Btu per cu ft was somehow synonymous with a satisfactory leaving temperature. For some one size of unit this is true. Diagrams above and on p 102, though, show how far from true it really is over a range of sizes.

A New Standard. A large measure of the misunderstanding now prevalent in the furnace-design problem would be removed, if a determined effort were made to (1) refrain from using Btu per cu ft and (2) adopt as a yardstick Btu available per square foot of exposed watercooled surface per hour. Just how will this come about?

The most important function of a furnace is to burn the fuel and properly condition the gases before entering the boiler. Only watercooled surface can reduce gas temperature. The engineer can assure himself that the comparisons he makes are true, not only between units of approximately the same size, but also between units of widely varying sizes, if he specifies that the design must conform to a maximum Btu released and available per square foot of projected watercooled-furnace envelope area per hour.

Consider for a moment how unscientific and wholly inadequate is the universally used yardstick "Btu per cu ft" in describing a furnace design. A measure of the volume tells absolutely nothing about the kind of surface by which it is enclosed (see above). And remember, only watercooled surface appreciably cools gas by absorption of radiant heat. As you increase a volume, the ratio of bounding surface area to volume diminishes. Btu per cu ft then can be used as a yardstick for comparison only if volumes are the same. Just what steps can be taken to find out how this yardstick should change for different volumes? This is the point where opinion and guess work come into the picture to plague and confuse thinking.

Btu available per sq ft per hr is a fundamentally sound unit for design comparisons. Why not use it? With so many natural variables in the pulverized coal-fired furnace problem, why go out of the way to compound difficulties by introducing an artificial one?

Gas Temperature. Occasionally engineers specify limits of furnace design desired by using a furnace exit-gas temperature as a measure of design limit. Usually when this device is employed, no description is given of the method by which the temperature is to be taken. This practice is not conducive to clear thinking or to obtaining comparable furnace offerings.

And here is why. It is known from work with high-velocity thermocouples over the last eight to ten years that in the range of temperature from 2000 to 3000 F a bare metal thermocouple exposed to furnace gases will register values of the order of 250 to 300 F below the true gas temperature.

The curve shown in Fig. 3 gives (1) high-velocity thermocouple (HVT) temperatures as a base and (2) a comparative reading of the bare metal thermo-

couple with relation to HVT (3) a reading of a multiple high-velocity thermocouple (MHVT).

The MHVT—a delicate laboratory instrument not practicable for everyday tests under operating conditions—registers within a few degrees of the true gas temperature. HVT, a more rugged tool capable of use under actual operating test work conditions, may easily be corrected by the use of curve. True gas temperature or MHVT value, then, may be used in design work.

Both HVT and MHVT have the metal junctions shielded from the direct effects of radiant heat. Gas is aspirated over them at increasing velocity until the reading levels off.

Differences in temperature, such as indicated on the curve throughout the range shown, are normally encountered in furnace exit gases. For this reason temperatures of this order should not be specified without also defining the method by which they are taken.

Ash Characteristics. In the design of the pulverized-coal-fired furnace, ash influences a designer's work probably more than any factor he contends with. He cannot know too much about it.

A notable contribution to clearer thinking on furnace design or specifications can be made if initial deformation, softening and liquid temperatures of ash on an oxidizing as well as a reducing basis are given.

SPECIAL SECTION POSTPONED

Unsettled conditions in the printing industry make it necessary to postpone the 16-page Special Section on low-voltage electrical protective devices scheduled for June POWER. If circumstances permit, it will appear in July.

Back in the days when stoker firing predominated, a laboratory procedure was established with the objective of determining the clinkering properties of coal when burned on grates. It involved the determination of these ash temperatures in a reducing atmosphere and this procedure is still the standard laboratory practice today. Under the circumstances prevailing then, this method made sense because it attempted to set up in the laboratory the conditions under which the clinkering took place. Today, however, with pulverized coal firing, tight furnaces, and excess air admitted at the burner except for the zone of highly active combustion, the ash particles are in an oxidizing atmosphere.

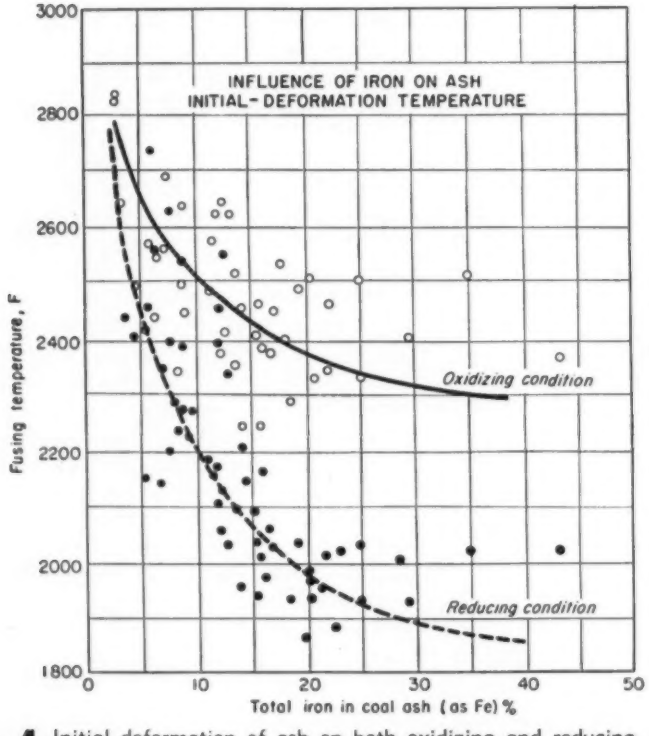
At the 1940 annual meeting of the ASME, Bailey and Ely presented data on the considerable difference in these ash properties when determination was in an oxidizing compared to a reducing atmosphere; differences were much greater as iron content of ash increased.

Fig. 4 and 5 show, from a wide variety of coal ash samples tested over a period of eight years at the B & W laboratory, that the lowest initial deformation on an oxidizing basis that has been found is about 2250 F.

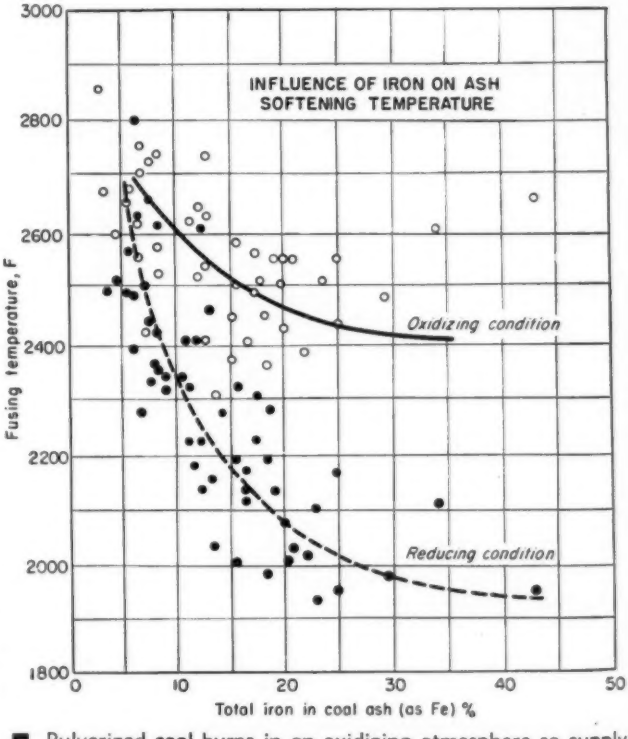
Since the fuel is burned and the ash passes to the furnace exit in an oxidizing atmosphere it would seem much more realistic for us to talk and think in terms of ash temperatures on an oxidizing basis and so have the values we use more in keeping with the phenomena we are describing.

Experience and tests tell us that when the average true gas temperature entering close-spaced tubes exceeds the oxidizing initial deformation temperature of the ash, troublesome slag accumulations may be expected.

Summary. Control of the temperature of gas leaving the furnace is a highly important aim of the specification writer. All the above is a plea for realistic thinking on this and other related design requests in this phase of the power field. Realistic thinking involves using (1) terms that apply (2) measurement methods that can be adapted to expected operating conditions (3) a full story on the characteristics of the fuel, especially where they predict fuel behavior in service.



4 Initial deformation of ash on both oxidizing and reducing bases helps set furnace limits for pulverizer and stoker

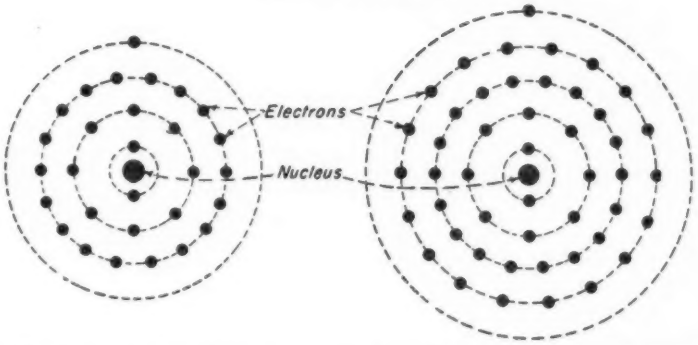


5 Pulverized coal burns in an oxidizing atmosphere so supply ash-softening temperatures on this basis in specifications

ELECTRONICS FOR THE POWER ENGINEER

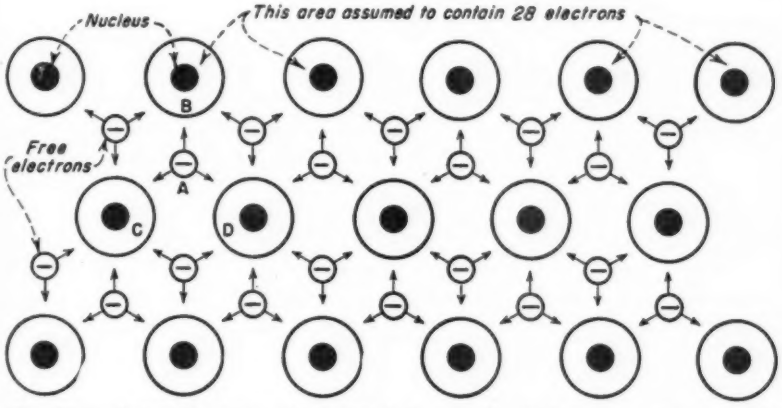
By F A ANNETT, *Associate Editor*

Free Electrons

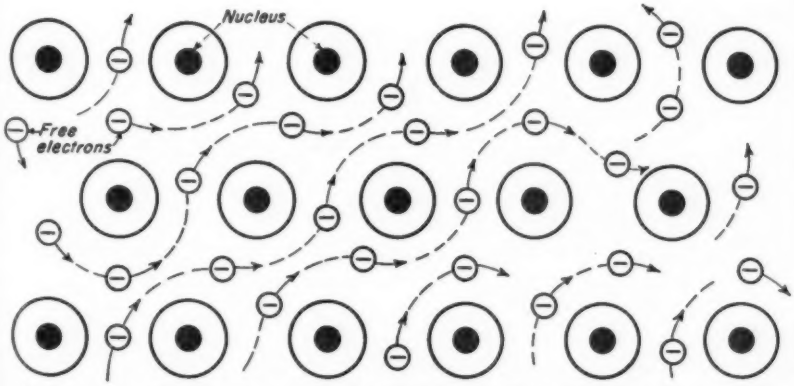


1 Copper atom has 29 electrons: 28 in 3 inner orbits, one in outer

2 Silver atom has 47 electrons: 46 in 4 inner orbits, one in outer



3 How free electrons—represented by small circles—in outer orbit of copper atoms may be influenced by the nucleus of two or more atoms



4 Arrows show how the free electrons—indicated by small circles—drift at random from one atom to another in the outer orbit of atoms

2—Electron Flow In Conductors

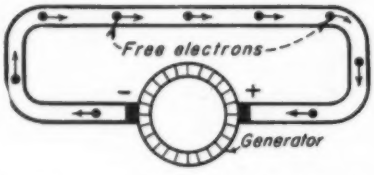
► NOT SO LONG AGO textbooks told us that the precise nature of electricity was not known, that it was an invisible and mysterious agent manifesting itself in many ways. Today we know that this invisible and mysterious agent is a flow of particles called electrons, which form part of all atoms. In the first lesson (POWER, April, p 105) we learned that the atoms of all elements are made up of a positively charged nucleus, or center, about which in orbits negatively charged electrons rotate. We also learned that their arrangement in these orbits gives each element certain chemical qualities.

With this conception of the atom's structure, let us consider electric-current flow in a circuit, as well as other effects. Flow of an electric current is now accepted as being a slow drift of so-called free electrons through a conductor. How these free electrons are made available has not yet been definitely established. One of the most rational conceptions maintains that electrons in the outer orbits of a conductor's atoms may at times be subjected to equal influences of two or more atoms.

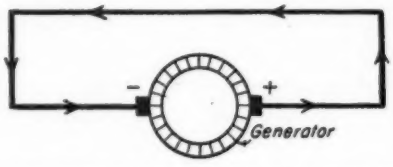
Free Electrons. The structure of good-conductor atoms gives a clue to the free-electron theory. For example, consider the copper atom, Fig. 1, which has 28 electrons in three inner orbits and one in an outer orbit. The inner-orbit electrons are closer to the nucleus than the outer ones. The three inner orbits also have their full number of electrons, which is a stable condition; they do not have a tendency to lose or gain electrons, as explained in the April issue.

For these reasons the inner-orbit electrons are bound more tightly to the nucleus than the single electron in the outer orbit. This single electron, outside of the three highly satisfied family circles, appears to be more

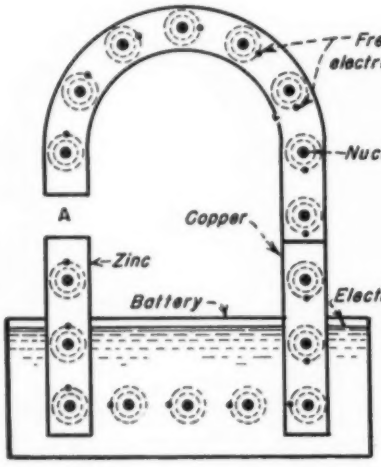
Current Flow



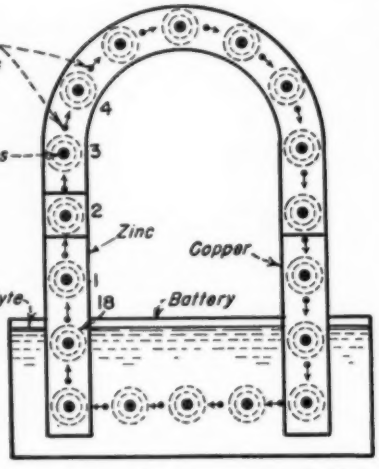
5 When voltage is applied to circuit, free electrons drift from negative to positive terminal of power source, as shown by the arrows



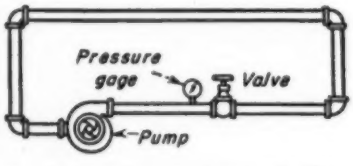
6 The old conception of an electric current was that it flowed from the positive to the negative terminal of power source, as arrows show



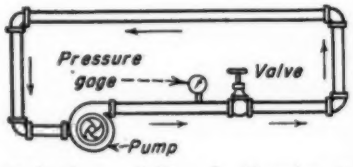
7 Simplified conception of conditions in an open electric circuit



8 In closed circuit, electrons slowly drift from one atom to another



9 Hydraulic analogy of Fig. 7 has centrifugal pump in circuit



10 Analogy of Fig. 8. If valve is open arrows show flow direction

or less of an outcast, free to go about as it pleases, wandering from one atom to another.

This course of reasoning also applies to silver, which is an even better conductor than copper. Its atom, Fig. 2, has a single electron outside of four closely held and satisfied electron family circles. Because the single electron is farther away from its nucleus in a silver atom than in a copper one, the outer electron is probably more loosely held in silver. This metal is, therefore, a better conductor than copper.

Fig. 3 shows how electrons in the outer orbit of copper atoms may be influenced by the nucleus of two or more atoms. Assume the heavy black dot at the center of each circle to be the atom's nucleus and the white area within the circle to contain the 28 electrons in the three inner orbits. The small circles outside the large one represent the single electron in the outer orbits.

In the position shown, each of these electrons is an equal distance from the nucleus of three atoms and is influenced equally by all three. For example, electron *A* is equally spaced from the nucleus of atoms *B*, *C* and *D*, and is free to follow an orbit around any one of them. It is also possible that some atoms temporarily lose their outer electron while others gain one. Under such conditions. atoms that lose an electron are positively charged and attract the first free electron that comes under their influence to restore their electrical balance. On the other hand, atoms with an excess of electrons are negatively charged and tend to restore their electrical balance by ejecting these electrons.

Current Flow. As a result the energy binding the outer electron to any particular atom is quite small and it drifts at random from one atom to another, somewhat as in Fig. 4. When a voltage is applied to the ends of a circuit it causes some of these free electrons to move toward the positive terminal of the power source, as in Fig. 5, their charge being negative.

This conception of the direction of electric-current flow in a circuit is the opposite of what we used to assume. When positive and negative terminals of a power source were first established a mistake was made in assuming that the supposed direction of an electric current was from positive to negative, Fig. 6. Now we know that the flow, if we may call it that, is in the opposite direction.

But the new conception does not make any difference in the operation of electrical equipment, as we can readily appreciate. In an ac (alternating-current) circuit, current flow is constantly changing its direction, usually 50 or 120 times per second. To trace a circuit in ac equipment we simply assume a direction of current flow and proceed just as for a dc (direct-current) circuit where the current always flows in one direction. When we discuss electron tubes we will further consider why an electric current flows from the negative terminal of a battery or generator to its positive, and not from positive to negative.

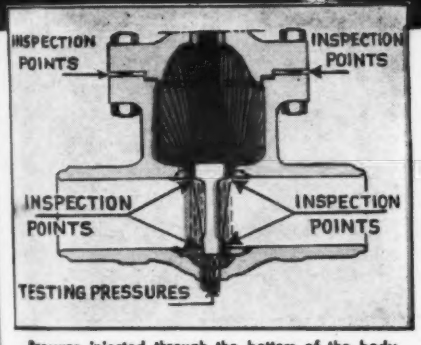
Until quite recently it was believed that an electric current flowed through a conductor at the speed of light, 186,000 miles per second. Now we know that the electron flow, which is the so-called electric current, is slow under normal conditions, but an electrical impulse is transmitted through the circuit at the speed of light.

When a voltage is applied to the ends of a circuit it creates a field of force inside the conductor. This field gives direction to the random movement of the free electrons and causes what appears to be their coordinated, slow, average drift from one atom to another. The higher the voltage applied to a given circuit. the faster the electrons drift along the conductor, consequently the greater the current.

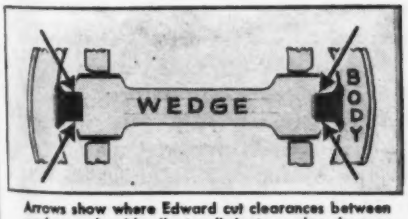
But, under normal full load on a light or power circuit the electron drift is only about 1 ft per hr. Conse-

EXCLUSIVE TEST METHOD PROVES *Simultaneous* tight seating of both faces of

Edward GATE VALVES

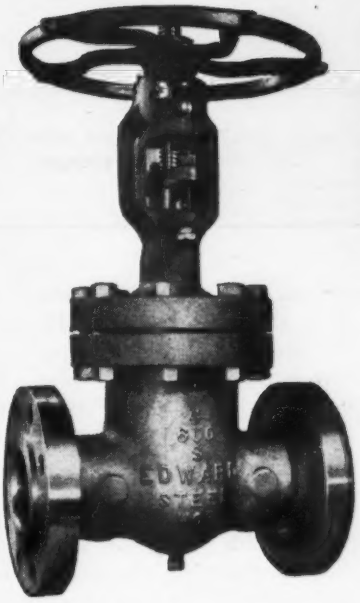


Pressure injected through the bottom of the body surrounds seats, yet leaves both ends open for simultaneous inspection in Edward testing method.



Arrows show where Edward cut clearances between wedge and guide ribs to eliminate wedge drag on seats. With Edward gate valve, partial turn of handwheel transfers load from seats to wedge guides.

Edward gate valve wedge guides are welded to body after seats are in place; therefore moving parts are accurately located. Seat rings are also welded in to prevent leakage between seats and body.



When Edward engineers began the design of a new series of steel gate valves, they tested other makes. Many of them were tight on one seating face or the other, but few were tight on both faces.

To build really tight gate valves, Edward engineers discarded the conventional method of casting guide ribs as part of the body and instead developed a new technique for welding the ribs into the body *after the machined seating faces were in place.* This, they demonstrated, reduced machining tolerances, eliminated wedge drag on the seating faces, and cut wear. They were also sure it meant a tighter valve.

But how to prove it? The result was the testing method shown above. Now, *all* Edward gate valves are tested with both ends open for simultaneous inspection, and both seating faces must be tight simultaneously.

The new Edward gate valves incorporate many other plus-value features, such as welded-in seats, one-piece bonnets, ball bearing yoke bushings in most sizes, and Stellite faced seating surfaces. With Edward, these features are standard construction.

For more details write for Catalog 12-E.

Edward Valves, Inc.

SUBSIDIARY OF ROCKWELL MANUFACTURING CO EAST CHICAGO, INDIANA

quently it may require days for the electrons in a long dc circuit to drift from one end to the other. In an ac circuit when the voltage reverses 50 or 120 times per second the electrons cannot drift far in either direction, but swing back and forth through short distances in the circuit.

Fig. 7 and 8 give an elementary idea of how electrons flow in a circuit, and show they transmit an electrical impulse almost instantaneously. In Fig. 7, the circuit is open at *A*. Assume that the large black dots are the nucleuses of copper atoms and that the inner dotted circle represents the three inner orbits with their 28 electrons, as in Fig. 1. The black dot in each outer dotted circle represents the 29th, or free, electron of each atom. For simplicity free electrons are all shown in the same position, even though when the circuit is open they drift at random in the conductor.

When the circuit is closed, as in Fig. 8, battery potential is applied to it and a mutual exchange of electrons occurs between the atoms as indicated by the dots with arrowheads: When atom 1 gives up an electron to atom 2, an electron from 2 goes to 3 and so on through the circuit to atom 18, which gives an electron to atom 1. Thus, when the circuit is closed an exchange of electrons between the atoms occurred at the same instant. In this way the effect of a comparatively slow flow of electrons is felt through the circuit at once.

This theory verifies to a degree the old belief that an electric current flows through a circuit at the speed of light. The chief difference in the old and new theory is in our conception of what happens in the circuit. The old conception assumed that when a circuit was closed to an electric power source an electric current flowed out of its positive terminal and traversed the circuit to the negative terminal almost instantaneously. The new conception assumes that electrons are caused to drift slowly through the circuit from the negative toward the positive terminal of the power source, but transmit an electrical impulse at the speed of light.

Electron flow through a circuit may be compared to water flow through a pipe. In Fig. 9, assume a centrifugal pump connected in a pipe circuit filled with water and the valve closed. When the pump operates it builds up pressure on the discharge side of the valve, as shown by the pressure gage, but water does not flow. If we open the valve water starts flowing in all parts of the circuit simultaneously, Fig. 10. That is, the instant water starts flowing from the pump's discharge, it also flows into the suction. Even though the water flow through the circuit may have a velocity of only a fraction of an inch per second its effects are felt in all parts of the circuit almost instantaneously. With water, its total volume moves in the pipe whereas in an electric circuit only the atom's electrons drift.

In Fig. 8 an electron flow is indicated through the battery solution as through the external circuit. This is not true; no electrons as such flow through the solution, but the effect is the same. Different actions occur in different batteries, some complicated and others quite simple.

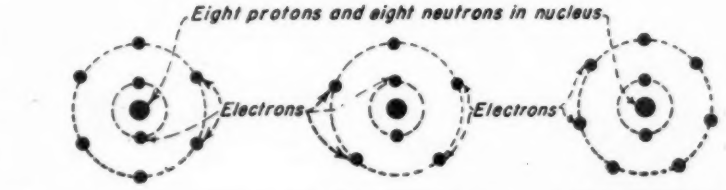
One of the simplest actions is that of a copper and a zinc plate in sulphuric-acid solution (electrolyte). The electrolyte acts to give a negative charge on the zinc plate, and a positive charge on the copper plate. That is, the zinc plate is given an excess of electrons whereas the copper plate is deficient in electrons. Then, when the external circuit is closed the zinc plate gives up some of its excess electrons to the conductor and the conductor supplies some of its electrons to the copper plate to supply its deficiency.

While the circuit is closed the electrolyte reacts on the plates to give the zinc an excess of electrons and keep the copper deficient so flow is continuous from the zinc through the external circuit to the copper plate. Movement of electrons in a vacuum tube is different from that in a solid conductor as will be shown later in this series.

For simplicity, in Fig. 8, we show a current flow of a single electron

(*Continued on page* 140)

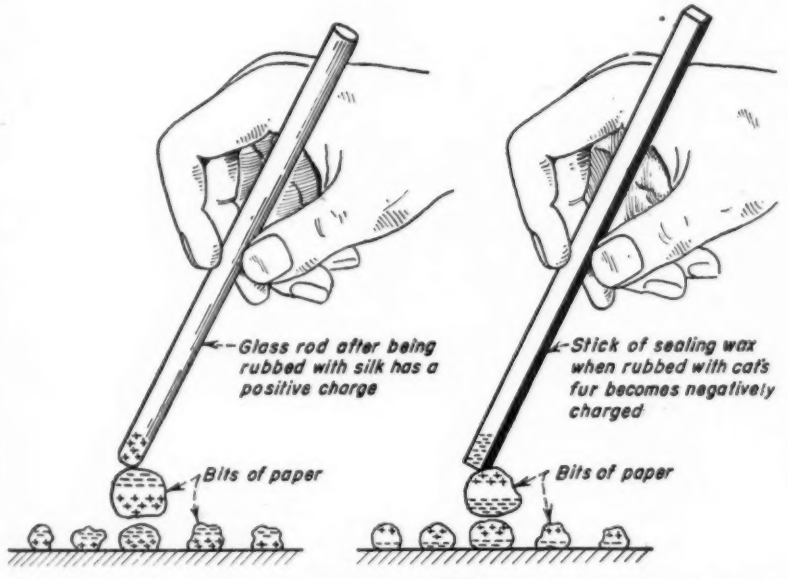
Positive, Negative Charges



11 Normal oxygen atom; 2 electrons inner orbit, 6 outer

12 If an oxygen atom loses an electron it becomes positive ion

13 Oxygen atom with an excess electron is a negative ion


Glass rod after being rubbed with silk has a positive charge
Bits of paper
Stick of sealing wax when rubbed with cat's fur becomes negatively charged
Bits of paper

14 After a glass rod is rubbed with silk it becomes positively charged and picks up bits of paper

15 Stick of sealing wax after being rubbed with cat's fur has a negative charge and picks up paper bits

Oil Company

"Without doubt, YARWAY Steam Traps are finest traps ever built. All trap replacements will be YARWAY hereafter."—Oil Company, Texas.

Cleaning Plant

"As soon as we installed the YARWAY trap our trouble ended. Since then, when other traps gave trouble, we put in YARWAYS and they always did a much better job. Now we use all YARWAY traps," says Maintenance Engineer of large mid-western cleaning firm.

Dairy Company

"YARWAY Traps have been a life-saver here. Used many different makes before trying YARWAY a year ago. Haven't touched them since. Trying to get management to buy more."—Large Wisconsin dairy.

Dye Works

"Use a good many YARWAY Traps here—like them very much on dryers. Take up little room and discharge condensate as fast as it comes through the line, causing coils to heat up faster and hold steady temperature."—Globe Dye Works, Philadelphia, Pa.

SPEAKING OF STEAM TRAPS

Laundry

"Ironer is so hot it sizzles after putting YARWAY trap on in place of a bucket trap. Run heavy spreads through ironer once and they are dry. Pulling out all bucket traps and will replace with YARWAYS."—Farina Laundry Co., Vancouver, British Columbia.

Power Station

"A great many YARWAY Traps are used here and have been very successful... some of these traps have been in use since 1939 and have given absolutely no trouble."—Herkimer Municipal Power Station, Herkimer, N. Y.

Florist

"Coal bill last winter was $5,000 less than previous winter. Didn't know whether they could give YARWAY Traps all the credit, but they were entitled to a big share of it."—Meyers and Santman (Greenhouses), Wyndmoor, Pa.

Hospital

"Ten years ago replaced an.....trap with a tiny ½" #60 YARWAY on an ironer. Never had such good results before. Trap has never been opened and still going 100%. Since then have bought nothing but YARWAY Traps and will specify them for new addition."—Northern Wisconsin hospital.

Textile Plant

"One large press formerly equipped with a bucket trap wouldn't heat lower platen. A ¾" YARWAY Trap was installed and since then full production has been maintained. This represents an increase of 20% in production."—Southern textile mill.

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½" TRAP

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POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

COMPRESSION RINGS EXTEND STEAM-PISTON LIFE

MANY SMALL reciprocating steam pumps with piston-operated slide valves use a simple plug piston. Such units serve as vacuum, boiler-feed, condensate and transfer pumps. Wear during service eventually allows steam blowby causing erratic operation and stalling. This condition, if not corrected promptly, leads to constant tampering with tappet collars and juggling of the throttle in an effort to keep the unit working.

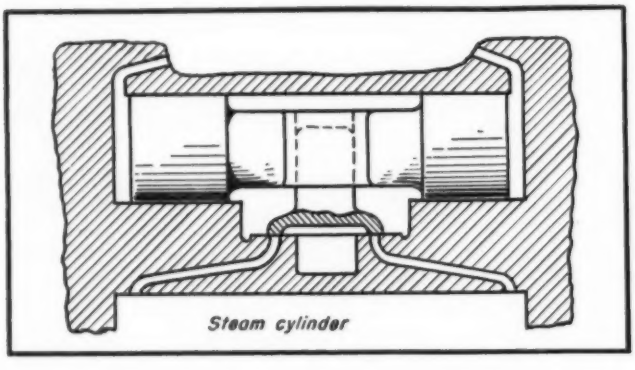
But correction, either by boring or honing the valve-piston bore and fitting an oversize piston or replacing the whole assembly, is costly.

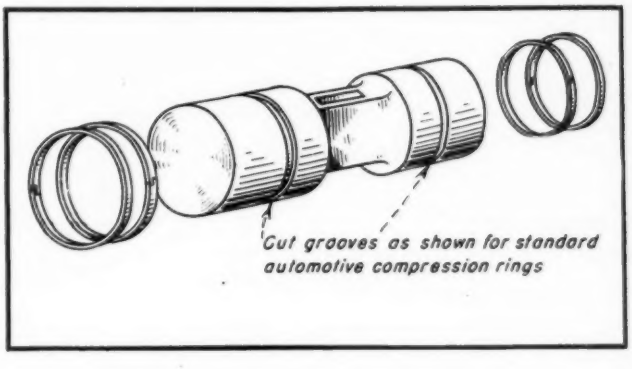
A number of years ago when new parts were not readily available, we had to make an emergency repair to such a unit. The method was so successful that it has been adopted as standard practice and has been used several times.

A narrow section on such plug-type pistons will take a ring groove and not allow the rings to pass over ports or out of the bore into the center open section, see sketches below. This must be located for each type, make and size of unit. The ring grooves should be made wide enough to receive two ⅛-in. wide rings, side by side. Standard automotive compression rings come in convenient decimal oversizes.

We have found this repair to give new part performance. Recent examination of a set after five years' trouble-free service shows no need of ring replacement as yet. Such repair on a small simplex pump costs only about $5 for machining and parts.

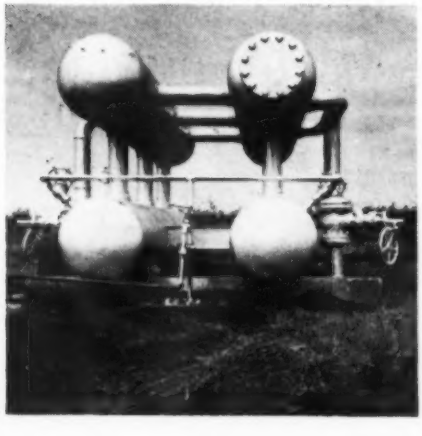
JOHN B MURPHY *New York, N. Y.*





FOUR TANKS MAKE EFFECTIVE GAS DRIER

IN EXTREMELY COLD WEATHER the natural gas supplied one plant was found to carry a small amount of water vapor.



This occurred in spite of careful dehydration before the gas was sent into the transmission mains. The water vapor and accompanying droplets of liquid hydrocarbons caused erratic action of fuel-regulating devices and variable gas-heating value.

A compact moisture separator was designed to dry the gas as shown in the photo. Gas enters the upper left cylinder through the single vertical pipe at the extreme left. It expands and changes flow direction in this cylinder, and then passes through the three horizontal connecting lines to the other upper cylinder. From here it emerges through the two branches of the loop to reach the single drop leg of the outlet line, at right. The unit is located between the gas-transmission line and delivery point.

Fluid released by the gas stream settles through one of the 4-in. nipples into the collecting cylinders, below, accumulating until the liquid level reaches the horizontal ¾-in. drain line in the foreground. Forced into these drains the liquid passes to the inverted-bucket trap in the pit. The trap opens to pass liquid but closes when gas reaches it. The ejected liquid collects in a small tank for disposal.

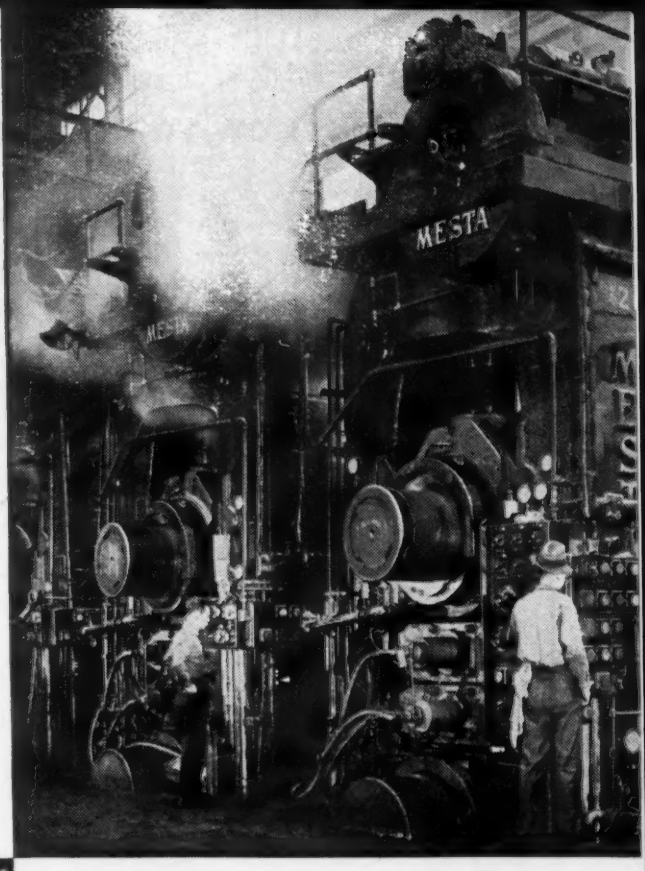
Two short sections of I-beam, welded between the lower cylinders, stiffen the assembly and counteract the force exerted by the gas pressure on the cylinders and connecting piping.

M H PEARCE *Carthage, Texas*

SUNVIS "900" OILS

. . for the toughest lubrication jobs

Sunvis "900" oils are in use today in turbines, circulating systems, hydraulic systems, textile machinery and in many other types of application.



Two years ago, we introduced our Sunvis 900 Oils, Sun's premium grade for industrial use. Since then, Sunvis 900 Oils have been proving their ability to resist oxidation and sludging under the most rigorous operating conditions. They stand up for long periods of continued use at extremely high temperatures without appreciable change in physical characteristics, body, color or "neut number." Sunvis 900 Oils possess a high viscosity index and in addition have the unusually low pour-point of 0°F.

Wherever continued operations, high speeds, heavy loads and extremes of temperature combine to threaten your equipment investment . . . wherever lubrication problems are really *tough*—rely on Sunvis 900 Oils. There are distinct grades specially created to meet the requirements of each kind of application. All are fortified against the formation of harmful oxidation products, sludge and rust.

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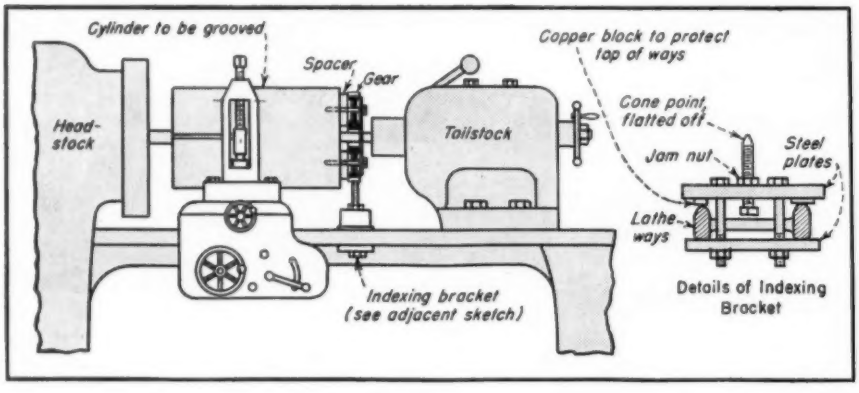
HOW TO DO MILLING WORK WITH A LATHE

CUTTING ACCURATELY SPACED grooves with a milling machine having an indexing head is a fairly simple job. The same work can be done on a lathe, however, when no milling machine is available. Here's how a lathe can be set up to cut axial grooves on the surface of a brass cylinder.

Having established the centers and turned the outside diameter of the cylinder, bolt a change gear, with the same number of teeth as the grooves needed, to the end of the cylinder by means of holes drilled through the arms. Center the gear with respect to the cylinder axis and clamp in a manner that will not interfere with application of the tailstock center to the work.

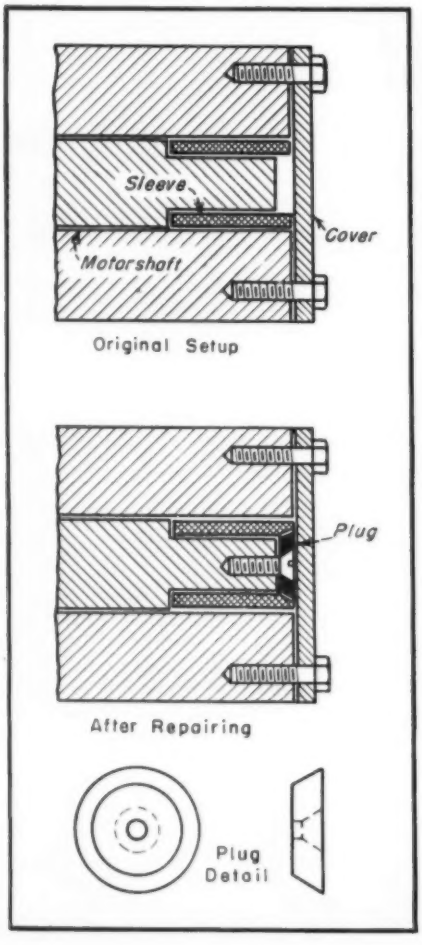
Assemble bracket to hold an indexing screw, as shown in the sketch below, and bolt to the lathe ways. The indexing screw should be a fine-thread bolt, threaded into the plate and secured by a jam nut. Turn a conical point on the screw, concentric with the thread, and flat it off so the screw binds between the teeth and does not bottom in the root of the gear.



To cut the axial grooves, grind a lathe tool to the desired shape and secure in the tool post lying on its side. Gear the lathe to give a coarse longitudinal feed and a slow spindle speed. The grooves are cut by traversing the carriage toward the tailstock with the work held in position by means of the screw in the indexing bracket. Remove the lathe dog and lubricate the headstock center with white lead during the cutting. After completing the cutting of each groove, index the work one tooth on the gear.

In doing work of this kind, as many cuts may be taken on each groove as necessary, but only a light cut can be made without chattering. Of course, the index gear need not have the same number of teeth as the number of grooves desired in the work as long as the teeth are evenly divisible by the grooves. The indexing screw may be engaged in every second, third, fourth, etc, tooth.

M G MOORE *Swampscott, Mass.*



Plug-Type Cap Holds Shaft Sleeve in Place

A USED COMPRESSOR UNIT, when installed in our plant, was found to have the outboard end of the motorshaft built up with a sleeve as shown in the top sketch at left. We assumed that the shaft had been damaged and rebuilt in this fashion to fit the bearing.

As everything looked shipshape otherwise, the unit was placed in service and ran steadily six days a week during a period of about six months. Then one day while the unit was running the sleeve was found projecting through the cover plate. It had loosened from the shaft and neatly drilled a hole through the cover plate—as smooth a job as a drill press could do.

To prevent a recurrence of this trouble another sleeve, similar to the one that had loosened, was prepared but it was chamfered at the outboard end. A plug was made to fit the chamfered end of the sleeve and a hole drilled and tapped in the end of the motorshaft. These elements were assembled and held together with a $\frac{3}{8}$-in. bolt, as shown in the sketch. The unit has run $1\frac{1}{2}$ years without further trouble of this or any other nature.

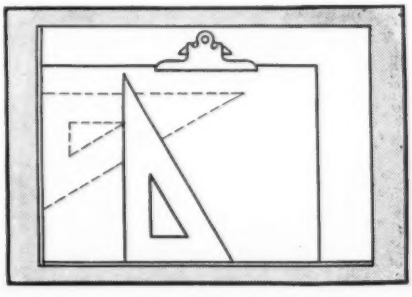
JOHN B THUMAN *Buffalo, N. Y.*

Edge Strips on Clip Board Aid Drawing

THE 11x14-IN. CLIP BOARD shown below has $\frac{3}{16}$-in. maple strips fastened to its left and bottom edges. These strips project $\frac{1}{8}$ in. above the board's surface. The clip allows quick removal or insertion of sketch sheets, which automatically square up against the projecting strips. Vertical and horizontal lines can be quickly and accurately drawn with the aid of standard triangles as shown. Edges of the board must be squared up before attaching the strips.

This board has been found to have great utility in the field, away from usual drafting-room conveniences, and even in the shop and office.

T E MILLER *Guild, Tenn.*



Take a *good* look at a *Liability*

Any boiler plant becomes a liability when improper water conditioning eats up profits by causing excessive blowdown, carryover . . . scale.

But this liability can be turned into an asset with *correct* water conditioning . . . a matter of careful and scientific control.

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PROBLEMS FROM THE PLANT

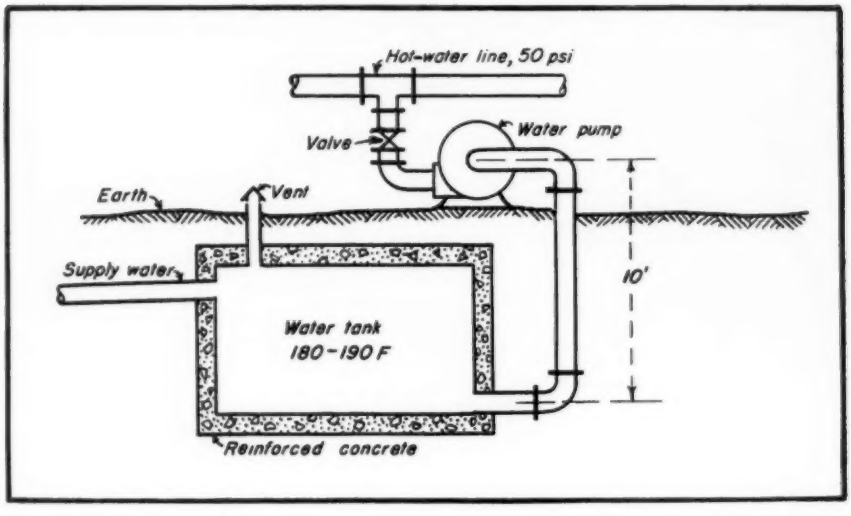
Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

How Can We Insulate and Waterproof Concrete Tank?

WE PLAN building a hot-water tank to store water for our laundry. The tank, to be constructed of reinforced concrete, will be located underground. We intend to insulate and waterproof it.

A pump will be installed to pump water from the tank into a hot-water line that feeds the various laundry units. Pressure in this line is 50 psi. The pump will be required to lift a 10-ft static head. Normal water temperature varies between 180 and 190 F.

Can POWER readers suggest methods of waterproofing and insulating the tank? What type pump is best suited for this application?—*AW*



Readers' Answers

How Can I Save Steam From Curing Cylinders?

(This question is from Feb issue with best answers from readers.)

To cure concrete blocks we use six cylinders, each 65 ft long and 6 ft in diameter. The blocks are stacked in the cylinders, which are then filled with live steam. The curing cycle consists of cooking for 2 hr at 12 psi, then gradually bringing pressure up to 100 psi and cooking for 4 hr. Steam is then exhausted to atmosphere in about 40 min. Only two cylinders are cooking at one time; the others are being filled or emptied. Each operation takes about 1½ hr.

Steam is generated in an hrt boiler having 2000 sq ft of heating surface. We draw raw water from the Detroit River for feedwater. At times we do not use the feedwater pump because we cannot keep steam up with cold water going into the boiler. We tried using an injector but it wastes a lot of time.

At present we are using about 4½ tons of 12,000 Btu coal in 24 hr. Coal is fired by an underfeed stoker.

Can Power readers suggest some way of using the exhaust steam so it will not be a total loss? I thought of using it to heat feedwater but don't know how to make use of it in the short exhaust period of 40 min out of each 12 hr. Maybe some engineer knows of a similar setup that has a good method for using waste steam—H W, chief engineer.

Preheat Cylinders With Exhaust Steam

I ASSUME *HW's* curing cylinders are trapped. If not, they should be, so as to return condensate to a receiver or open heater.

I suggest his cylinders be piped in such a manner that when two cylinders are coming off the line the steam be exhausted over to the two cylinders going on the line. Cylinders will then be partly heated before starting.

Feedwater is probably treated, so every pound of steam returned as condensate is a saving, both in feedwater treatment and labor. **William T Mullen, Philadelphia, Pa.**

Regulate Exhaust Time And Feedwater Flow

IT SEEMS as though *HW* could reduce coal consumption and improve boiler operation with a well-insulated feedwater storage tank. It should have sufficient coils in the bottom to condense steam and pick up a greater part of the heat before dumping condensate. I mention dumping as it is unlikely that condensate would be fit for boiler feed purposes because sand and cement are picked up during the curing period when steam is in contact with cement blocks.

Just before blowing down steam from curing tanks, water in feed tank would be at a low level. When steam is released, raw water should be fed to tank and continued for duration of blowdown period.

Tank size is determined by the amount of steam released during blowdown period, having sufficient water to condense steam and transfer heat. **R E Fontaine, Buffalo, N. Y.**

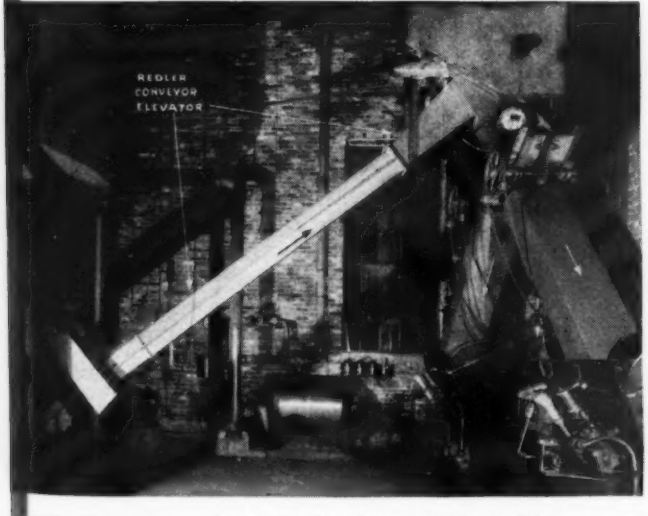
Reschedule Curing Periods

I SUGGEST THAT *HW* schedule plant operations so, on completion of the 100-lb cooking period, the steam is exhausted into another cylinder. The second cylinder has been filled, closed, and is standing ready for the warm-up and 12-lb cooking operation. This requires that he shorten the exhaust time by using larger pipes and valves. The proposed plant operation is shown on

How S-A bulk material handling systems cut costs, solve problems in many fields

CLEAN, gentle handling is assured for the grain processed in this plant. The weather-tight REDLER feeds itself a uniform load at the railroad track, elevates to the third floor, and discharges to various bins . . . in a single, compact conveyor unit . . . without contamination, spillage or dust. Write for more information on S-A conveyor systems for food products.

2-IN-ONE Sorting Conveyors with end sections hinged, to lower clean coal into cars, with minimum breakage at this Indiana preparation plant. The S-A pan conveyors shown, permit removal of slate and foreign materials. Another conveyor beneath disposes of the refuse. Write for information on S-A conveying and screening equipment for handling coal, ore, and stone at lowest cost.



NO DIRT. Coal dust has been eliminated from many boiler rooms with compact, dust-tight REDLER conveyor units like this. One conveyor draws coal from storage, elevates, and fills several stoker hoppers. In other cases, closed-circuit REDLERS store and reclaim from any part of large storage bunkers. Write for suggestions on a compact, economical conveyor system for your power plant.

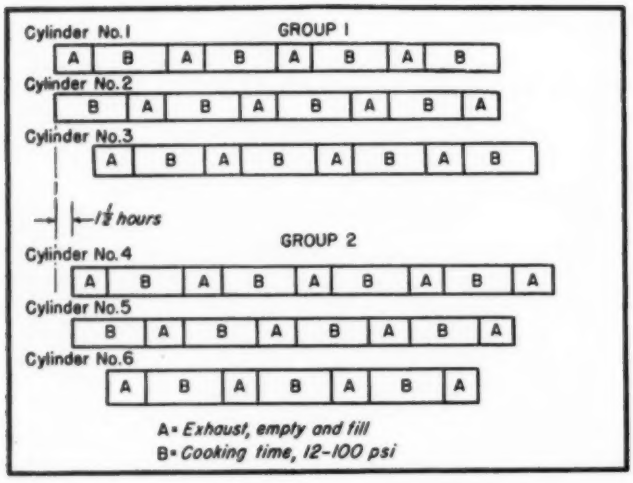
VOLUME, reliable operation and low maintenance for many years was guaranteed for this S-A belt conveyor by the use of "Pacific" carriers. Timken tapered roller bearings take the punishment of heavy loads of stone and gravel. Pressure lubrication and labyrinth seals protect from dirt and weather. Write for data on S-A belt conveyors for dependable, large volume, low cost handling.

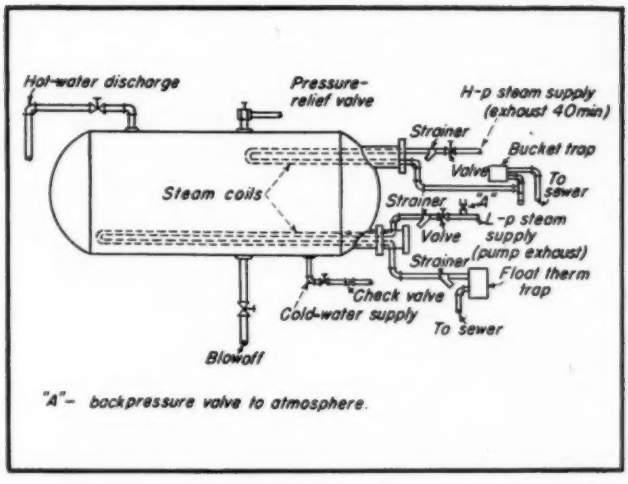
STEPHEN S-A ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT





the above chart on the basis of 9 hr. per cylinder charge. Here we see that as No. 1 cylinder completes the 100-lb cooking operation it is exhausted into No. 2 cylinder, 2 exhausts into 3; but 3 exhausts into 1, and the cycle repeats on group 1.

Note that the chart shows the six cylinders divided into two groups with group 2 delayed 1½ hr after group 1. This difference is to avoid the heavy steam flow required in warming the contents of the cylinder after the exhaust has been shut off.

With the data *HW* has supplied, my calculations indicate that his 200-hp boiler is not operating at rated capacity. I suggest he look to that region for considerable improvement.

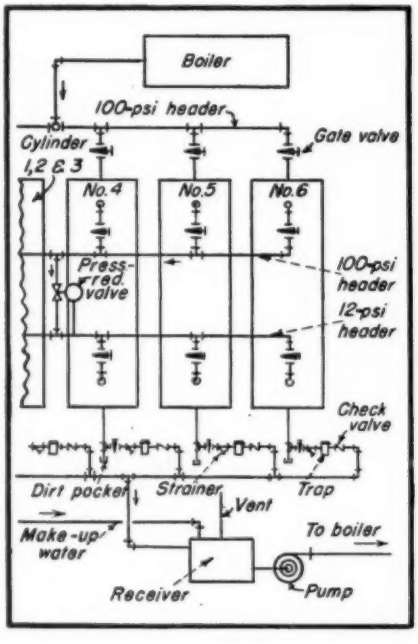
See *Rock Products* of October 1946 for further information. **John A Graham, Pittsburgh, Pa.**

Connect Cylinders Through Pressure-Reducing Valve

SINCE *HW's* BOILER has scarcely sufficient capacity to cook two cylinders at once and each cycle requires 12 hr, each pair of cylinders is idle for several hours between cycles. Therefore it is not too important that exhausting be done in 40 min. Assuming this is true, instead of exhausting to atmosphere, *HW* can exhaust through a pressure-reducing valve into the next pair of cylinders to be cooked. When these cylinders are through with their 100-psi cooking they can be exhausted through the pressure-reducing valve, which is set at 12 psi, into the third pair of cylinders, and so on around.

It is possible that before the 4-hr 100-psi cooking is completed, the concrete blocks will be saturated with heat to the point where there will be some excess boiler capacity. At this point the valve may be opened, allowing steam to pass through the pressure-reducing valve into the second pair of cylinders, starting their 12-psi cooking before the first pair are through. This not only saves steam but by overlapping cycles, production is increased.

Evidently *HW* has attempted to recover some condensate, as he mentions using an injector. A boiler feedwater pump can be installed that draws water out of an open receiver. The curing cylinders can be drained through steam



traps, as shown in above sketch, and their condensate allowed to flow into this receiver. Additional makeup water can be pumped from the river into this same receiver by a separate pump. **R W Winget, Tulsa, Okla.**

Install Feedwater Heater

THERE ARE SEVERAL WAYS *HW* can save steam. As it is exhausted for only 40 min at the end of the curing cycle, continuous operation of a feedwater heater is unwarranted. Condensate from the cylinders may be used for heating purposes by piping it through a counter-flow closed heater installed in the main condensate-discharge line.

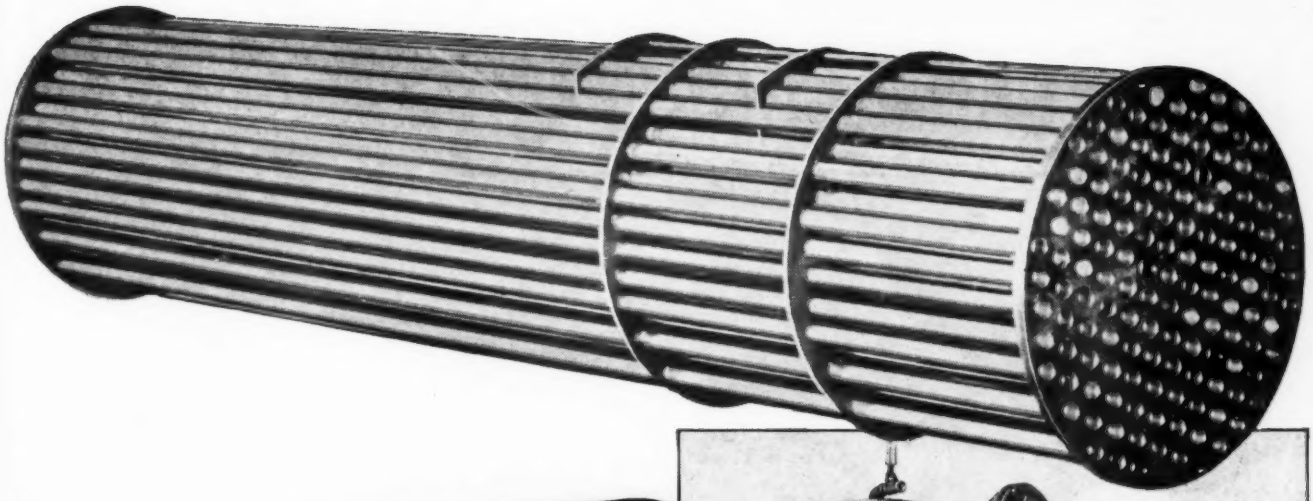
For a steam-driven pump, I suggest the method shown in above sketch. It entails a larger investment but pays for itself over a period of time. Remember that saving from the installation of a feedwater heater in the average plant is about 10 to 15%. For every 11 F added to temperature of the feedwater using exhaust steam, there results approximately 1% fuel saving.

As the boiler has 2000 sq ft of heating surface we can assume its hp is about 200, evaporating between 6000 and 6900 lb of steam per hour at rated capacity. The storage heater would have to be large enough to handle 831 gal of water per hour. As the sketch shows, provision is made to use the steam that is exhausted at the end of the curing cycle. In this way, all available exhaust steam is used. **J B Thuman, Buffalo, N. Y.**

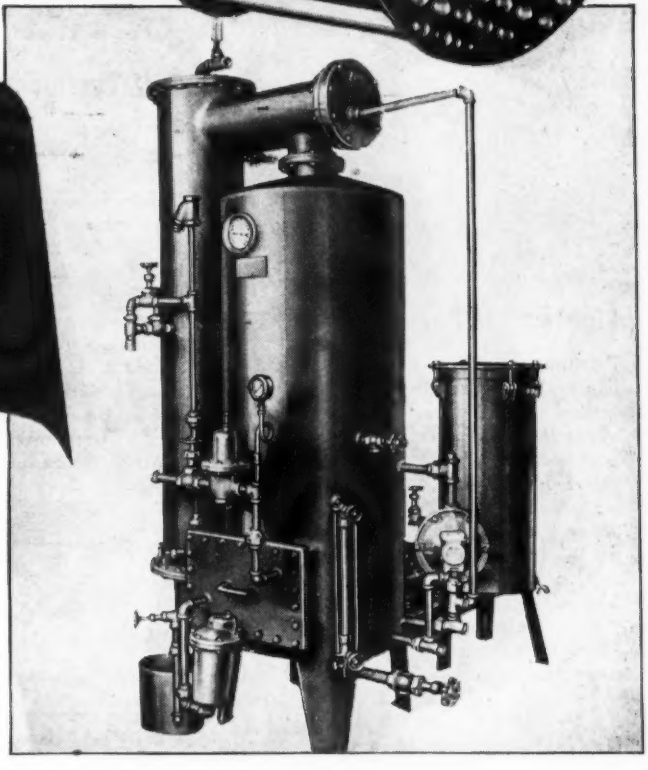
Rearrange Operating Time

HW CAN SAVE STEAM from his curing cylinders by rearrangement for proper coordination of his process on a continuous-flow basis. Fortunately six of his cylinders are involved, making arrangement simple. During each 2-hour period a set function is being performed in each of the six cylinders. Let us say, for the period between 12 noon and 2 pm, cylinder 1 is being filled, cylinder

(*Continued on page* 148)



In this vacuum still, tubes of ARSENICAL ADMIRALTY mean extra durability



BUILT BY The United States Hoffman Machinery Corporation, Syracuse, New York, for use by dry cleaning plants in reclaiming cleaning solvent, this vacuum still contains Anaconda Arsenical Admiralty Condenser Tubes in its heat transfer element. In this brass alloy, the inclusion of a small percentage of arsenic increases resistance to dezincification and promotes longer life under corrosive conditions.

Condenser tubes of Arsenical Admiralty alloy are noted for giving consistently satisfactory performance in almost every kind of service.

For heat exchange applications there are ten standard and several special Anaconda Tube Alloys—a range which makes it possible to supply Anaconda Tubes for a wide variety of needs.

Engineers and equipment manufacturers are invited to use the broad experience and metallurgical knowledge of our Technical Department in determining the most suitable alloys for specific heat exchanger requirements. For general information on Anaconda Condenser and Heat Exchanger Tubes and Tube Sheets, send for Publication B-2. 48134

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HEAT EXCHANGER TUBES

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

NEW PLANT EQUIPMENT

Lightweight Pumps E138

PRIMING AT HIGH SUCTION lifts features lightweight self-priming pumps. Classed as general utility units, they may be used where lightweight and easy transportation is required. The *Midget*, 1½-in. pump, powered by 1½-hp single-cylinder, 4-cycle air-cooled engine, has maximum capacity 86 gpm at 30-ft head, maximum suction lift 30 ft, priming time 1¼ min at 25-ft suction lift, weight 62 lb. Powered by a 5-hp engine, 3-in. pump has 280-gpm maximum capacity at 30-ft head, priming time 1⅓ min at 25-ft suction lift, weight 117 lb. **Gorman-Rupp Co, Mansfield, Ohio.**

Radiation Pyrometer E139

PYRO RADIATION PYROMETER is designed to give quick and accurate readings of temperatures above 1000 F by thermoelectric principles. Instrument is completely self-contained, weighs less than 2 lb, is direct reading and requires no outside connections, lead wires, batteries, or other accessories. It is only necessary to sight the instrument at object being measured and read the temperature on a direct-reading scale. **Pyrometer Instrument Co, 103 Lafayette St, New York, N. Y.**

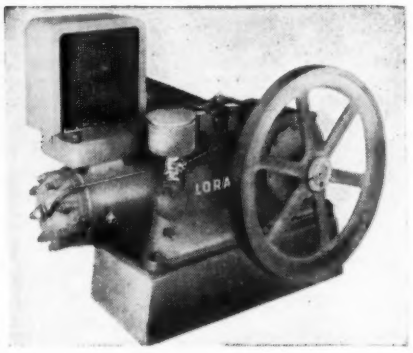
Vertical Gearmotor E140

CONSISTING OF a complete high-speed vertical motor, a self-contained drive and speed-reducing unit, these self-contained gearmotors are available in 3 to 50 hp, 220, 440 or 550 v, 3 phase, ac, and 3 to 7½ hp, 115 or 230 v, dc. They may be equipped with nearly any standard motor, including open protected, semi or totally enclosed, and explosion proof.

Design of gear case is such that all gears and bearings receive positive lubrication at all operating speeds. Unit is quiet in operation, having single helical gears and pinions designed for maximum strength and low impact stress and wear. **Westinghouse Electric Corp, Pittsburgh.**

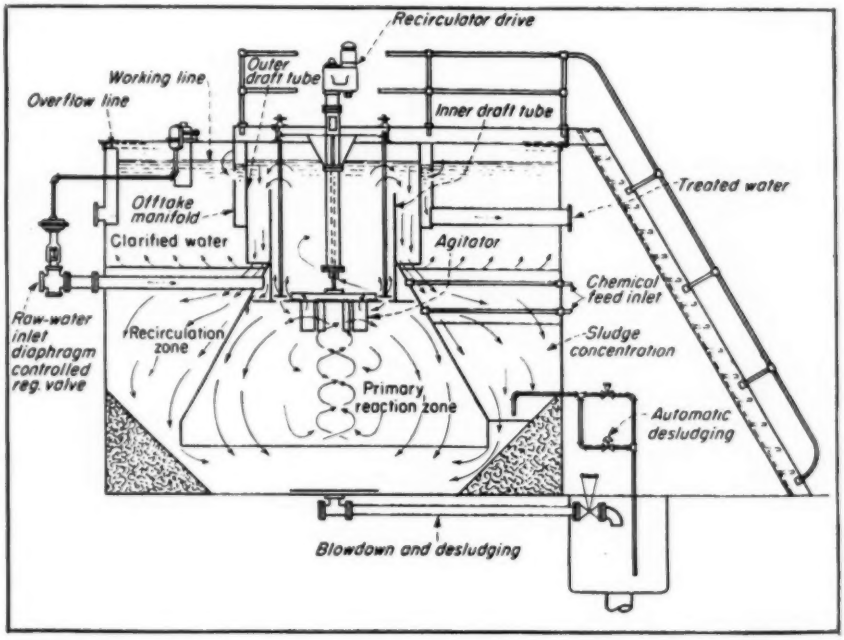
Dial Thermometer E141

PRINCO EASY-SETTING DIAL THERMOMETER permits adjustment of both dial and pointer to any point within a full 360 deg while instrument is in service. Thermometer contains a bimetallic sensitive unit. Available in 11 standard scales, covering a total range of —100 to 850 F, or the equivalent in Centigrade. Has an accuracy of 1% of range at any point of indication. It is available with stainless-steel stems in four standard lengths, 4, 6, 9 and 12 in. long. Separable sockets can be furnished in standard metals. **Precision Thermometer & Instrument Co, 1401 Brandywine St, Philadelphia 30, Pa.**



Horizontal Diesel Engine E142

DESIGNED FOR OPERATION as a cold-starting full diesel or for ready field conversion to burn natural gas or butane, the new *Lorain* Type *O* single-cylinder horizontal 2-cycle engine is rated at 34.3 hp at 450 rpm. The 9½x10-in. cylinder is fitted with wet liners of alloy cast iron to assure long life and ready replacement. Crankshaft and cross shaft are equipped with Timken bearings. Condenser-type cooling system eliminates need for a water pump, and makeup water is negligible. Standard equipment includes *Twin Disc* clutch, *Pierce* governor, *Air Maze* oil-bath filter and *McCord* lubricator. Over-all dimensions are: height, 59 in.; length, 88 in.; width, 58 in. Shipping weight is 3800 lb (domestic) and 4500 lb (export). **White-Roth Machine Corp, Lorain, Ohio.**



Water Purifier E143

THE RAPID REACTOR combines the basic elements for mixing, floc formation, settling, and thickening in a single reaction vessel. Chemical reagents may be introduced for coagulation of turbidity alone, for partial softening with coincident turbidity reduction, or for complete softening and turbidity reduction. In operation, raw water is introduced into an environment of chemical reagents and preformed precipi-

Use convenient reply cards on page 176a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

No worry about "weak links" when all piping is Crane

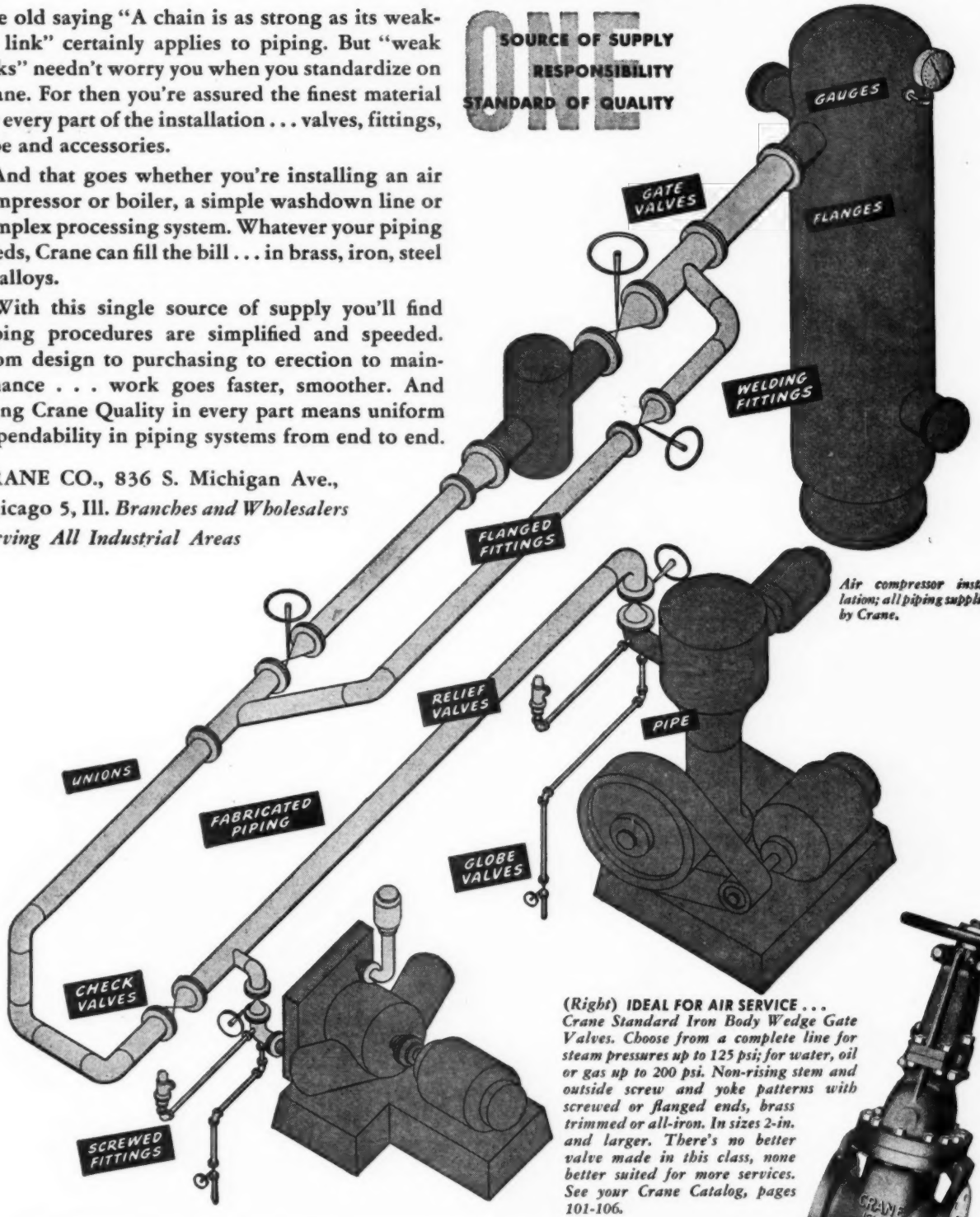
The old saying "A chain is as strong as its weakest link" certainly applies to piping. But "weak links" needn't worry you when you standardize on Crane. For then you're assured the finest material for every part of the installation . . . valves, fittings, pipe and accessories.

And that goes whether you're installing an air compressor or boiler, a simple washdown line or complex processing system. Whatever your piping needs, Crane can fill the bill . . . in brass, iron, steel or alloys.

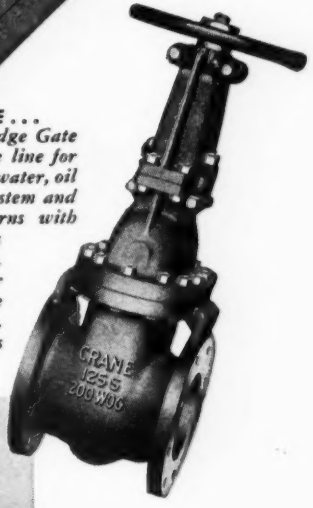
With this single source of supply you'll find piping procedures are simplified and speeded. From design to purchasing to erection to maintenance . . . work goes faster, smoother. And using Crane Quality in every part means uniform dependability in piping systems from end to end.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas*

ONE SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY



Air compressor installation; all piping supplied by Crane.



(*Right*) **IDEAL FOR AIR SERVICE . . .** *Crane Standard Iron Body Wedge Gate Valves. Choose from a complete line for steam pressures up to 125 psi; for water, oil or gas up to 200 psi. Non-rising stem and outside screw and yoke patterns with screwed or flanged ends, brass trimmed or all-iron. In sizes 2-in. and larger. There's no better valve made in this class, none better suited for more services. See your Crane Catalog, pages 101-106.*

EVERYTHING FROM . . .

VALVES . FITTINGS
PIPE . PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

tates, thoroughly agitated, and discharged into a zone of relative quiescence at controlled velocity. It finally passes into an integral settling and thickening reservoir from which it is collected for use. Retention time depends upon the characteristics of the raw water and the purpose for which the treated water is to be used, but usually is 60 to 70 min. **Cochrane Corp, 17th St & Allegheny Ave, Philadelphia 32, Pa.**

Wound-Rotor Motor E144

A TOTALLY-ENCLOSED fan-cooled, wound-rotor motor has an improved tube-type air-to-air heat exchanger. Greater efficiency of this heat exchanger permits a reduction in size, and because of its simple design, cleaning is reduced to a minimum. Improved motors are suitable for all industrial fields.

The motor can be built with stainless-steel ventilating tubes, fans, and end plates. In addition, cast-iron terminal boxes and collector ring enclosures may be specified for motor operation under extremely unfavorable atmospheric conditions. **Allis-Chalmers Mfg Co, Milwaukee, Wis.**

Humidifier Unit E145

COMPACT, SELF-CONTAINED HUMIDIFIER contains within its 13¾ in. x 14¾ in. x 6 in. deep cabinet four humidifying nozzles, water tank with float valve, water strainer, air filter, air regulator with pressure gage and solenoid-operated valve. A humidistat also forms a part of the unit but it is separate from the cabinet.

As supplied, humidifier unit is ready for connection to air line, water line and electrical circuit. The four nozzles atomize 35 lb of water per hr using 5 cfm of atomizing air at 32 psi. These nozzles can be adjusted for position in the cabinet. **Spraying Systems Co, 4021 W Lake St, Chicago 24, Ill.**

Portable Extension Cord E146

A UNIQUE EXTENSION REEL, the *Port-O-Reel*, is designed to save time on any application requiring extension cords. This new unit prevents kinks and knots in the cord by a cord guide that winds the cord as it is rewound on reel.

The standard unit handles any length of cord up to 400 ft, depending on diameter of cord. It is available with or without extension cord. The manufacturer will equip the reels with special hand lamps, plugs, and any type cord and cable to meet code requirements of standardized wiring system now in use. **Industrial Electrical Works, 1509 Chicago St, Omaha 2, Nebr.**

Pipe Wrench E147

RED-E-BASIN PIPE WRENCH is designed to reach inaccessible fittings. Made from high-strength alloy steel forgings, the grip-lock teeth are carefully machined and case hardened for long service. The eccentric, instantly reversible jaw automatically grips round, square or hexagon parts. **American Die & Tool Co, 2nd & Buttonwood St, Reading, Pa.**

Pump Packings E148

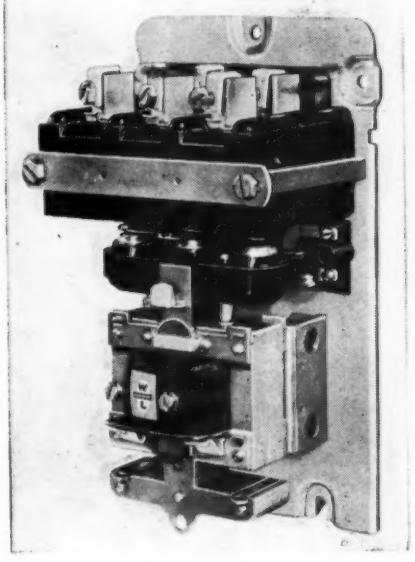
PACKING, compounded to resist damaging effects of hot caustic solutions, is for reciprocating pumps and similar equipment. It is self lubricating to assure low friction on piston rods and prevent leaks. For tight-sealing service on centrifugal pumps handling caustic solutions, a packing made of lubricated braided asbestos has been produced. Both packings are available in a wide range of sizes. **Quaker Rubber Corp, Tacony and Comly St, Philadelphia 24, Pa.**

Wall Heater E149

VERTICAL, SEMI-CYLINDRICAL, nickel-chrome heating element comes in 1500, 2000, 3000 and 4000 watt capacities for 230 v, ac operation. It heats by both radiation and convection. Built-in thermostat with adjustable control maintains desired temperature for this easily installed, grill-faced wall heater. **Electric Heating Dept, Westinghouse Electric Corp, Emeryville 8, Calif.**

Reciprocating Compressors E150

CUSTOMIZED LINE of reciprocating compressors, ranging from 5 to 100 hp, is designed for either air-conditioning or low-temperature duty. Units are so constructed that they can be assembled in more than 1000 different combinations, making it possible to custom tailor each complete unit to fit exact requirements of each installation. Entire line is designed so that the compressor, motor, base, coupling and condenser can be individually selected to match specific requirements of job. Construction features include automatic load-free starting, built-in automatic load levelers, external control of capacity, vapor-cushioned valves, removable cylinder sleeves, vapor-cooled cylinders, removable precision bearings, oil-cooled shaft seal, automatically reversible oil pump, and magnetic oil drain plugs. **Carrier Corp, Syracuse, N. Y.**



Solenoid Contactors E151

INTENDED PRIMARILY for ac motor controllers, these new solenoid-type contractors are also suitable for application in resistive heating controls, lighting controls, etc, for remote and automatic load-switching purposes.

The device features a compact unit con-

Use convenient reply cards on page 176a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

SEE REVERE

FOR CONDENSER TUBES AND PLATES

EXPERIENCE has proved that in a majority of installations Revere Admiralty Metal condenser tubes, inhibited to resist dezincification, will give long, satisfactory and economical service. However, Revere also makes tubes in Cupro-Nickel, Revalon (aluminum brass), Red Brass, Muntz Metal, Arsenical Copper, and Copper, thus enabling you to select the Revere Metal or Alloy best suited to meet your operating conditions.

In addition, Revere manufactures pipe and tube in copper and brass for general piping purposes, and electric welded steel tube.

Revere condenser plates can be had in a number of alloys in squares, rectangles, circles, half-circles, segments, and special patterns, up to 120 inches maximum dimension, finished weight about 11,000 lbs. maximum. These plates are flat, dense, free from blow holes or other imperfections, accurate in gauge, and are easily machinable.

As each condenser, heat exchanger or other piece of equipment using tubes and plates presents an individual combination of conditions, no blanket recommendations are possible. Among the factors to be considered are: chemical and impingement attack, velocities, pressures, temperatures, air entrainment, suspended solids. Should short tube life or other circumstances lead you to question your present practices, the Revere Technical Advisory Service will gladly cooperate with you in making thorough field and laboratory studies, to assist you to determine the most serviceable and economical alloys.

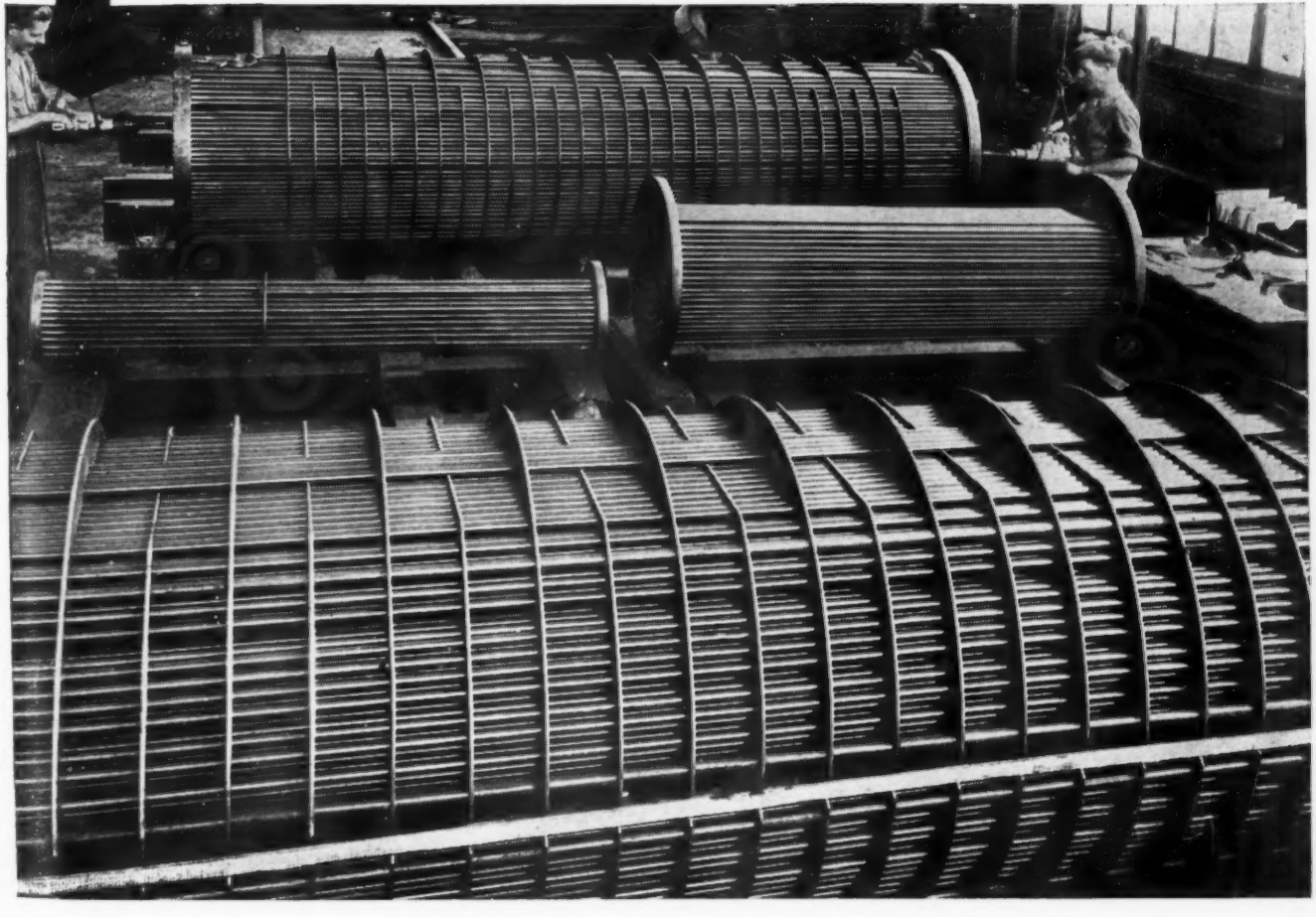
REVERE

COPPER AND BRASS INCORPORATED

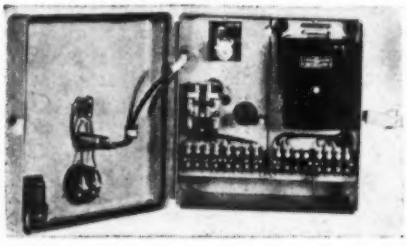
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y. — Sales Offices in Principal Cities, Distributors Everywhere.



struction in addition to complete accessibility of parts, built-in solderless connectors, double-break silver contacts, and simplicity of design. Size 2 and size 3 units have maximum ratings of 25 and 50 hp, respectively, on 440-550 v, 3-phase, 60 cycles. Standard operating coils with front-connected terminals are available for 110-, 220-, 440- and 550-v operation on 25, 50 or 60 cycles. **Ward Leonard Electric Co, Mt. Vernon, N. Y.**



Oil-Burner Control E152

PHOTOELECTRIC COMBUSTION CONTROL shuts off flow of fuel to an oil burner immediately if oil fails to ignite or flame goes out. For gas-electric ignition systems it stops flow of fuel if gas pilot does not ignite.

This system allows burner motor to operate for a definite interval after shut down for purging. A manual reset must be made to change the system from lock-out once a failure has occurred. **Control Div, General Electric Co, Schenectady 5, New York.**

Universal Metal Worker E153

VERSA-MIL drills, mills, bores, faces and grinds (externally, internally and surface). Normally attached to lathe carriage and adjustable at any angle, *Versa-Mil*, a complete motorized ½-hp unit, is easily carried to any job for operation as a self-contained machine tool for maintenance operations on engines, turbines, pumps, compressors, motors and other power equipment.

Belted drive speeds from 33 to 14,000 rpm. Further worm gear reduction drives heavy-torque shaft 33 to 395 rpm. **Versa-Mil Co, 30 Church St, New York 7, New York.**

Compressor Regulator E154

NORTON COMPRESSOR REGULATOR controls machine load according to air requirements. Regulator keeps compressor operating continuously, adjusting the load according to discharge requirements. Continuous compression of even small amounts of air cushions piston at all times at end of stroke. Manufacturer says this method of operation increases volumetric efficiency 10%. Unit is interchangeable with conventional type regulators because it uses the standard equipment tubing or piping that is on the compressor. Body is bronze with a neoprene diaphragm that is impervious to oil or water. A self-aligning valve requires no lubrication or attention. **Norton & Shea Co, 916 Wallace St, Erie, Pa.**

Plate Magnets E155

PERMANENT MAGNETIC SEPARATORS remove tramp iron from materials traveling down chutes or through ducts. They protect grinders, crushers, stokers, pulverizers, susceptible to damage by iron and for purification of grain, coal, fertilizer, rubber, etc.

The magnets are a series of "C" shaped alnico magnets with their poles fastened to steel plates and mounted on an aluminum plate. A section of the chute's bottom is cut out and the magnet installed in its place, which is hinged so that it can swing away for removal of collected iron. Steel pole plates projecting up from magnet's face provide edges that help mechanically to arrest and hold the iron.

Standard units are available in a range of sizes 4 to 72 in. wide in increments of 2 in. Special magnets can be built to suit requirements. **Dings Magnetic Separator, 4740 W McGeogh Ave, Milwaukee.**

Industrial Spotlight E156

POWERFUL ENOUGH to illuminate clearly welding, cutting or brazing work when viewed through a No. 10 welder's glass, this spotlight allows welder to see the work before striking arc. One of these spotlights casts a small-diameter circle of light from 2500 foot-candle brilliance when placed 3 ft from the work to 1000 foot-candles when 6 ft away.

Spotlight uses a 6-v, sealed-beam type of lamp, operating from a transformer built into the light housing. Complete assembly weighs about 5 lb. It can be mounted at any angle on some convenient 1-in. pipe, or on its own stand, by a clamp and positive-action, spring-loaded swivel joint. Spotlight may be plugged into any service outlet as power requirement for the lamp and accessories is only 30 watts at 115 v, 60 cycles.

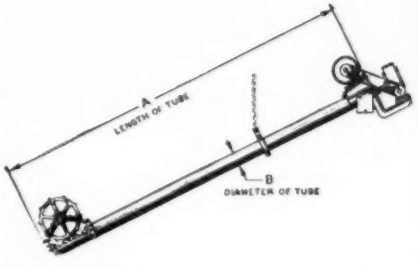
They are available as single units, complete with built-in transformer and clamp, or in a combination of two spotlights and a 6-ft pipe stand with built-in receptacles, a foot-operated switch and power cord. **Westinghouse Electric Corp, 306 Fourth Ave, Pittsburgh 30, Pa.**

Thread Compound E157

PIPETITE-STIK JOINT COMPOUND withstands Freon, gasoline, oil, butane, propane, ammonia, brine, gas, oil and water, and steam. It lubricates and completely seals pipe-joint threads, nuts, bolts and gaskets. Joint can be remade without having to clean the threads. It comes in two sizes, regular and jumbo. Both sizes may be carried in pocket or tool kit ready for instant application. **Lake Chemical Co, 607 N Western Ave, Chicago 12, Ill.**

Crane Control E158

CONTROL UNIT for overhead cranes consists of a simple rotor and a stationary field member through which braking forces are exerted electromagnetically. It makes possible with ac power a smoothness of control and speed which previously could only be obtained with dc power. **Harnischfeger Corp, Milwaukee, Wis.**



Stoker Feeders E159

SCREW-TYPE STOKER FEEDERS "pipe" coal direct from storage to stoker. An electric motor, belt-connected to a power transmission, drives the screw feed. A universal joint centers the screw. A shear pin in this

(Continued on page 136)

Use convenient reply cards on page 176a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

NALCO DELIVERS

Continuous Benefits

TO REFRIGERATION USERS

Here's Proof: Of the many plants using Nalco service and chemicals for efficient performance of refrigerating systems:

68% have been using the Nalco System for over 5 years;

54% have employed Nalco for more than 10 years, and

69% of this over-10-year group have enjoyed freedom from water treatment failures for more than 15 years.

You do not buy a product or a service year after year unless it is continuously successful. For a permanent answer to your water treatment problems, consult Nalco.

Laboratory samples of living algae used for experimentation work in the constant battle against the green marauders.

The facilities of the world's finest water treatment laboratories are at the service of Nalco users.

Prevent scale, corrosion, algae in cooling towers, diesel-cooling systems, condensers, boilers, recirculating water systems with Nalco Treatment.

NATIONAL ALUMINATE CORPORATION

6222 W. 66th Place, Chicago 38, Illinois

Canadian inquiries should be addressed to
Aluminate Chemicals, Ltd., 555 Eastern Ave., Toronto 8, Ontario

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How to plan

STEAM and WATER PIPING FOR A DYE PLANT

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

This typical dye plant hookup, includes a dyeing machine, hot water tank and drying room connections. Although the machine shown here is used expressly for dyeing bolts of cloth, the piping would be similar for other types of machines used in dyeing any textile finished goods.

All three major pieces of equipment are connected directly with the main steam line which furnishes primary heat for the dyeing machine and drying room, and auxiliary heat for the hot water tank. Exhaust steam from the drying room is utilized as the primary heat supply for the hot water tank.

The cloth passes through the vats containing dye in water solution which is kept at the required temperature by thermostatic controls. This solution is heated by the steam admitted through the perforated pipe. After material has been dyed, it is transferred to the drying room, or chamber, which is supplied with hot air from unit heaters, special blower units, or other radiation suitable for the particular installation. Steam connections from the main steam line are thermostatically controlled.

If exhaust steam from the drying room is inadequate to heat the amount of water required, the thermostatically controlled auxiliary steam coil fed directly from the main steam line goes into operation. The exhaust steam line from drying room to the hot water tank should contain a bypass around the tank to condensate return lines. This will allow operation of the drying rooms when the primary heating coil in the hot water tank is not in operation.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation. Copies of Layout No. 34 will be sent on request. Just mail coupon.

Fig. 106-A, a Renewable Disc Bronze Globe Valve, is designed with a convenient slip-on, stay-on disc holder that permits a quick change of disc. The resilient composition disc assures drop-tight closure. The sturdy screw-over bonnet is unaffected by repeated disassembly and reassembly.

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34

Fig. 106-A
Renewable Composition Disc
BRONZE GLOBE VALVE
150 Pounds Steam
300 Pounds O.W.G.

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STEAM and WATER CONNECTIONS FOR DYE PLANT

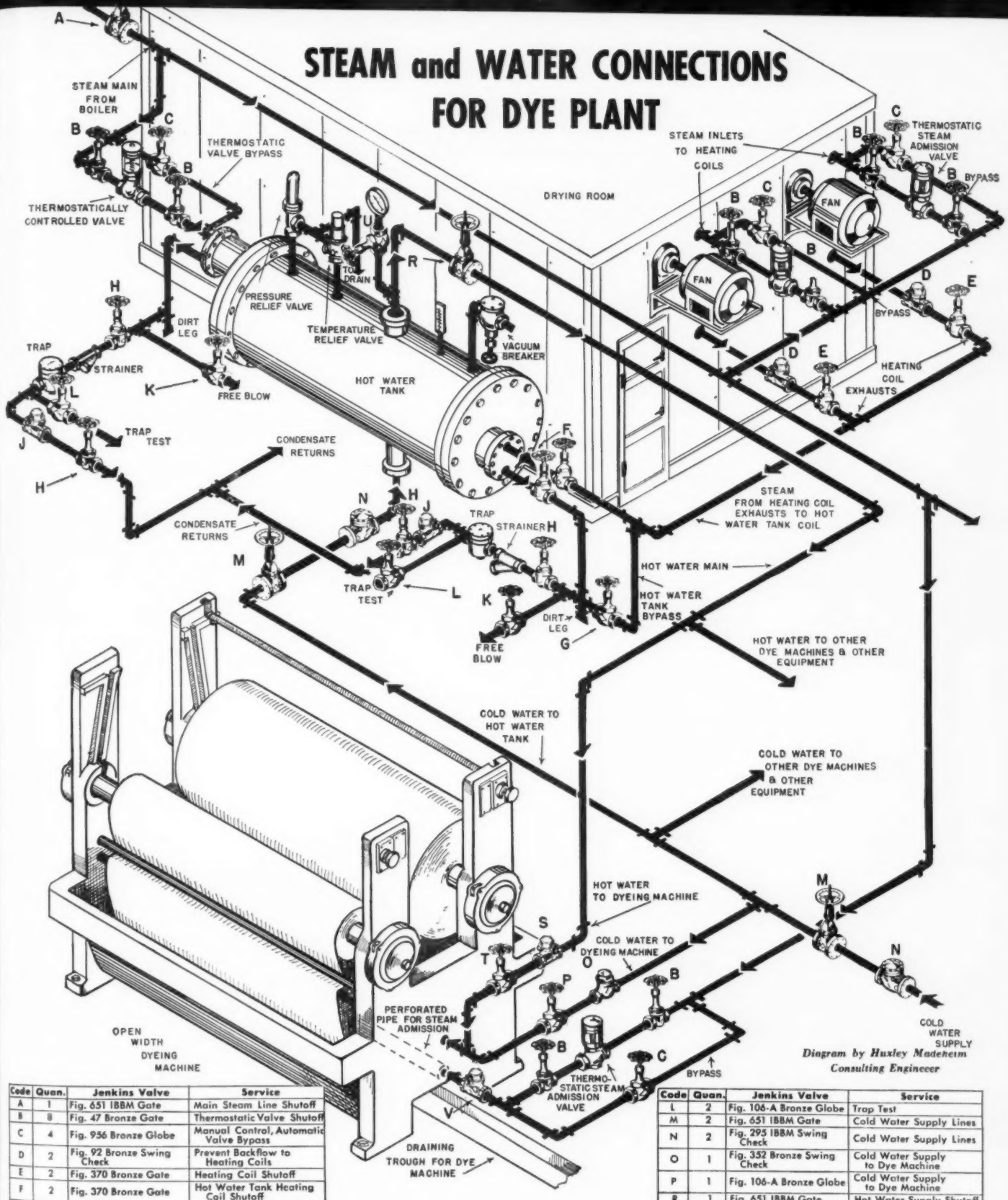

Diagram by Huxley Madeheim Consulting Engineer

Code	Quan.	Jenkins Valve	Service
A	1	Fig. 651 IBBM Gate	Main Steam Line Shutoff
B	8	Fig. 47 Bronze Gate	Thermostatic Valve Shutoff
C	4	Fig. 956 Bronze Globe	Manual Control, Automatic Valve Bypass
D	2	Fig. 92 Bronze Swing Check	Prevent Backflow to Heating Coils
E	2	Fig. 370 Bronze Gate	Heating Coil Shutoff
F	2	Fig. 370 Bronze Gate	Hot Water Tank Heating Coil Shutoff
G	1	Fig. 106-A Bronze Globe	Exhaust Steam Bypass of Heating Coil
H	4	Fig. 370 Bronze Globe	Trap Shutoff
J	2	Fig. 92 Bronze Swing Check	Prevent Condensate Backflow
K	2	Fig. 106-A Bronze Globe	Free Blow on Condensate Lines

VALVE RECOMMENDATIONS
For details and valves to suit varying conditions see Jenkins Catalog

Code	Quan.	Jenkins Valve	Service
L	2	Fig. 106-A Bronze Globe	Trap Test
M	2	Fig. 651 IBBM Gate	Cold Water Supply Lines
N	2	Fig. 295 IBBM Swing Check	Cold Water Supply Lines
O	1	Fig. 352 Bronze Swing Check	Cold Water Supply to Dye Machine
P	1	Fig. 106-A Bronze Globe	Cold Water Supply to Dye Machine
R	1	Fig. 651 IBBM Gate	Hot Water Supply Shutoff
S	1	Fig. 92 Bronze Swing Check	Hot Water Supply to Dye Machine
T	1	Fig. 106-A Bronze Globe	Hot Water Supply to Dye Machine
U	1	Fig. 106-A Bronze Globe	Pressure Gage Control
V	1	Fig. 92 Bronze Swing Check	Prevent Back Flow to Steam Line

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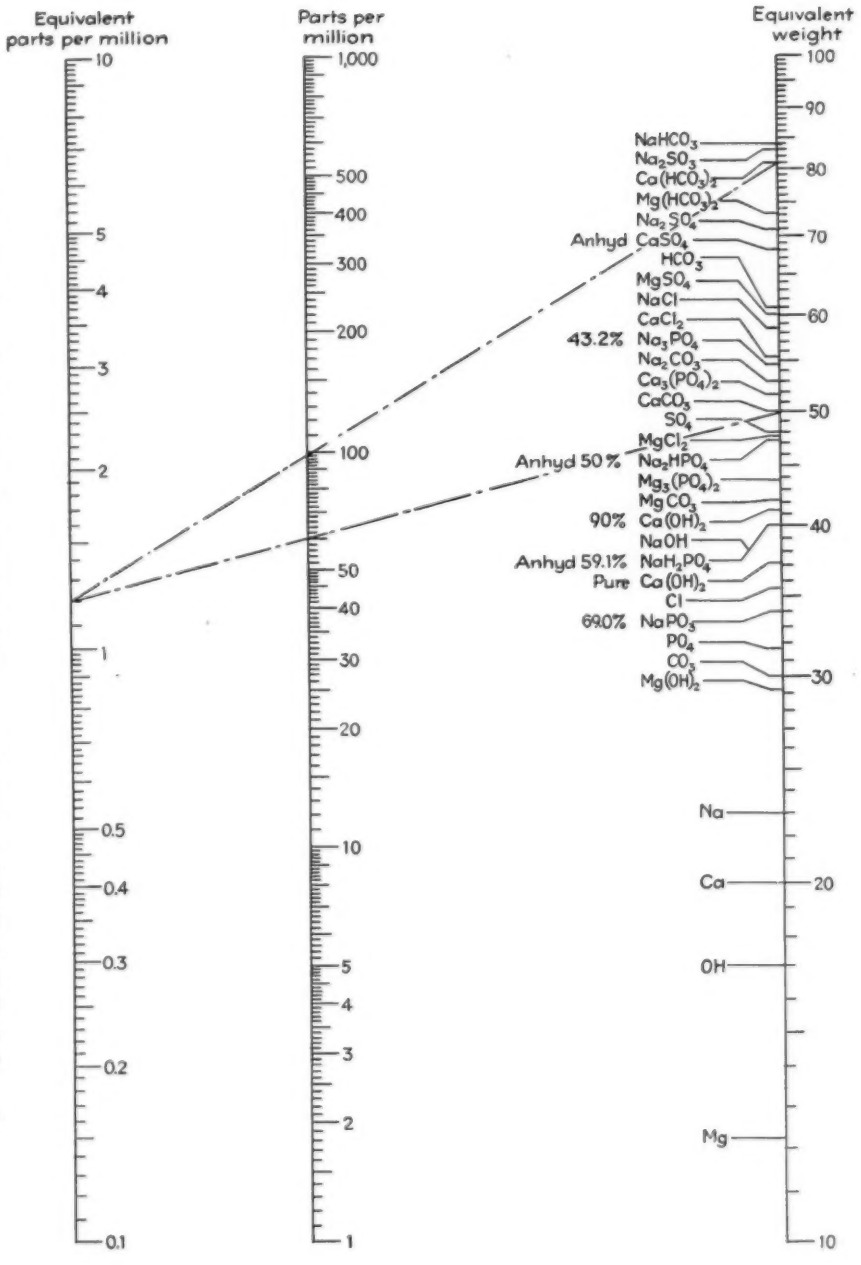
Number 190

Feedwater Chemistry Conversions



▶THIS CHART can be used to figure: (1) the equivalent parts per million (epm) of the salts and ions found in boiler feedwater when they are given in terms of parts per million (ppm); and (2) ppm in terms of another salt or ion. Chart range suits most practical purposes. To minimize the need of table references, the commoner salts and ions are identified on the equivalent weight scale.

To use the chart, lay a straight edge connecting the equivalent weight and ppm values of the substance on the appropriate scales and read the epm on the intersection with the left-hand scale. If the corresponding ppm of another substance is desired connect the epm value as found above and the equivalent weight of this other substance and read the ppm on the middle scale.

Example: Find the epm of 98 ppm of calcium bicarbonate, $Ca(HCO_3)_2$ and then express this concentration in terms of ppm of calcium carbonate, $CaCO_3$.

Find the equivalent weight on the right-hand scale for the bicarbonate as 81.0 and connect this point with 98 ppm on the middle scale, reading 1.2 epm on the left-hand scale. Then connect this epm value with the equivalent weight for the carbonate found as 50.0 on the right-hand scale, and read at the intersection with the center scale, 60 ppm.

By John F Hyam

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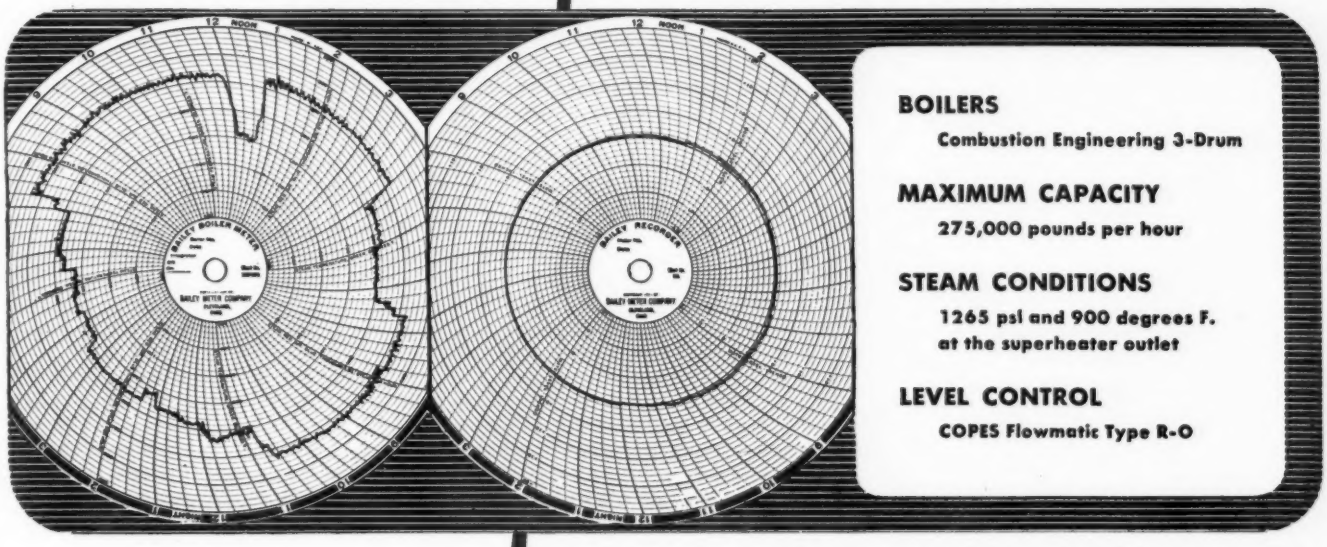
FLOWMATIC

5 YEARS IN SERVICE

CONTINUES TO *Hold*



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COPES Flowmatic Type R-O

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If you want close boiler water level control, consider these charts. They show level held within plus-or-minus one-half inch over a load range of 110,000 pounds per hour. They were recorded five years after COPES Flowmatic was placed in service. During this period, the only servicing needed was the routine care by plant personnel. Depend on COPES!

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TECHNICAL BRIEFS

ENGINEERING DEVELOPMENTS HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

WATER TREATMENT

Demineralization Process, *by Daniel J Saunders, Permutit Co.* This paper begins with discussion of a water practically clear and colorless and ready for demineralization.

Many industrial services find calcium and magnesium salts the most troublesome minerals. Lime and soda methods made up the first hardness-removing treatments. Then about 40 years ago the zeolite cation-exchange process was invented. In this process, sodium-zeolite-treated water contains sodium salts equivalent in amount to chlorides, sulphates and bicarbonates in the original water. Total dissolved solids stay the same as untreated water. In some instances such a condition is objectionable.

Acid-resistant, carbonaceous, sulphonated coal zeolites became available in 1936. Hydrogen ions replace sodium, calcium and magnesium ions in water under this acid-zeolite treatment. Adding an alkali, such as sodium carbonate or caustic soda, or blending with the proper amounts of sodium-zeolite-softened water neutralizes hydrochloric and sulphuric acids formed by ion exchange. Carbonic acid formed in this same process decomposes into free carbon dioxide, and degasification will remove it. Concentrations of chloride and sulphate in the raw water constitute the limiting factors on just how low total dissolved solids can go with this process.

Demineralizing by acid-absorbent anion exchangers produces a water of an electrolyte content equivalent to commercially distilled water. This process removes the sulphuric and hydrochloric acids formed in the cation process Removal of carbonic acid still requires gasification. Fig. 1 shows the usual two steps involved in the acid-absorbent anion exchangers: (1) the conversion of salts to acids (2) the removal of these acids.

Silica removal down to 1-3 ppm can be achieved by pretreatment where turbidity or color in raw water makes such treatment necessary. Ferric hydroxide floc or magnesium hydroxide act as silica absorbents in pretreatment.

For more complete silica removal, two methods are available: (1) Soluble fluoride can be added to water entering a hydrogen cation-exchange unit and later an anion exchanger. (2) Hydrogen-zeolite treated water is passed through a special highly basic anion-exchange resin. Both methods give a water with silica content of only a fraction of a ppm.

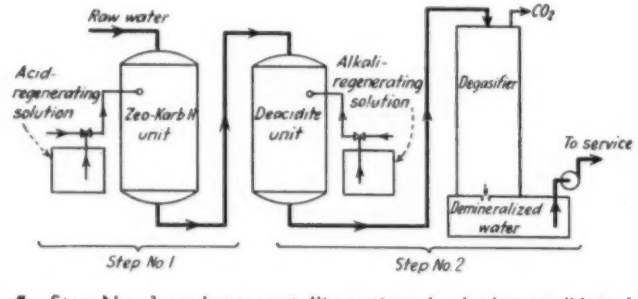
Choice of method involves a complete engineering study including (1) tolerance permissible for various constituents in the treated water (2) operating costs such as equipment, fuel, chemicals and labor. These costs vary with location, water, fuel and chemicals. Fig. 2 helps compute chemical costs. Paper No. 3206-1-48. *Available upon request from Permutit Co, 330 W 42nd St, New York 18, N. Y.*

Technical and Economical Aspects of Water Purification for Ships, *by R V Kleinschmidt, Arthur D Little, Inc.* Water supply aboard ship has been a problem as long as man has sailed the seas. Because steam evaporators have fuel, scale and operating problems their use has not been universal. Many cargo vessels still carry "shore water."

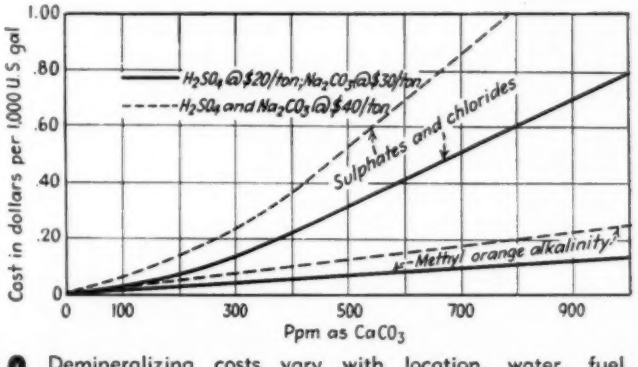
The Kleinschmidt Vapor Compression Distilling unit, originally developed for the Marine Corps for Pacific island service, meets ship service requirements for these cargo vessels. It has five major parts: (1) mechanical power source — turbine, internal-combustion engine or electric motor (2) steam compressor equal to compressing 225 cu ft of steam down to 3 to 5 psig for each gallon of water produced (3) evaporator to boil raw water and condense compressed steam (4) heat exchanger to heat incoming raw water by means of distillate and waste brine from the evaporator (5) heat source for starting the unit, usually waste heat from engine jackets or exhaust.

Auxiliaries under certain conditions include a feed pump to supply and meter water, a condensate pump if water is to be delivered any distance or to an elevated tank, a steam-pressure gage on compressor discharge; a manometer on the evaporator, a feed-regulating valve, a compressor steam bypass valve, drain and vent cocks, evaporator-cleaning equipment. *ASME Paper No 47-A-136.*

(*Continued on page* 130)



1 Step No. 1 replaces metallic cations by hydrogen (H ion) and converts salts in raw water to acids. Step No. 2 removes acids formed in Step No. 1. The deacidite unit absorbs HCl and H_2SO_4. H_2CO_3 decomposes and degasifier vents CO_2



2 Demineralizing costs vary with location, water, fuel, chemicals. Chart above shows dollar cost for chemicals

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Shown here are typical pages from the new J-M Goetze Gasket catalog illustrating a few of more than 30 standard Goetze designs that are available now for high temperature, high pressure service. Goetze Gaskets are fabricated of many metals, in practically any required shape or cross-section. Available sizes range all the way from tiny gaskets measuring one-eighth of an inch in diameter and weighing but a fraction of an ounce to huge 34-foot gaskets weighing more than a thousand pounds.

You'll find up-to-the-minute engineering data—including a handy reference chart showing construction details of many popular designs—in the complete Johns-Manville Goetze Gasket catalog, just published. Write today, on your company letterhead, for your copy. Address Johns-Manville, Box 290, New York 16, New York.

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Johns-Manville *Goetze* Gaskets

Table I—Fuel Costs for Heating; Northwest U. S.

Heat source	Price	Btu contained	Efficiency of use, %	Cost per million, Btu	Annual cost*	Equivalent power cost for heat pump COP=3.5
Bituminous coal	$9.00 per ton	20,000,000 per ton	65	$0.69	$115	$0.0082 per kwhr
Oil	0.09 per gal	140,000 per gal	75	0.86	138	0.01 per kwhr
Gas, mfd	0.60 per m cu ft	570 per cu ft	75	1.40	234	0.017 per kwhr

*Maximum demand =85,000 Btu per hr; design temperature = +10 F; heating season =4500 deg days

Table II—Fuel Costs for Heating; Northeast U. S.

Heat source	Price	Btu contained	Efficiency of use, %	Cost per million, Btu	Annual cost*	Equivalent power cost for heat pump COP=3.5
Anthracite coal (stoker)	$11.10 per ton	27,000,000 per ton	65	$0.63	$126	0.0075 per kwhr
Oil	0.087 per gal	140,000 per gal	75	0.83	166	0.001 per kwhr
Gas, natural	0.75-0.38 per m cu ft	1,050 per cu ft	75	0.95-0.48	190-96	0.011-0.006 per kwhr
Gas, mfd	0.65 per m cu ft	550 per cu ft	75	1.58	316	0.019 per kwhr

*Maximum demand =100,000 Btu per hr; design temperature =0 F; heating season =5400 deg days

THE HEAT PUMP

A Heat Pump in an Office Building, *by J Donald Kroecker and Ray C Chewning, consulting engineers, Portland, Ore.* Well water serves as the source of heat for the building's needs in the winter months. Its cost is that of pumping it to the required floor level. In addition, heat is recovered from exhaust ventilation air; and waste cooling water heats the ventilation air to produce an estimated one-third reduction of heat requirements. Automatic switchover from heating to cooling or the reverse is possible in this 12-story office building equipped with the largest heat pump in the U. S. Water is drawn at different temperatures from wells at two levels. Circulating air acts as the heat-transfer medium. *ASHVE Paper.*

Economic and Technical Aspects of the Heat Pump, *by W E Johnson, Air Conditioning Dept, General Electric Co.* The more southerly portions of the U. S. seem the most favorable market for the heat pump. Requirements for design heating about equal those for cooling. To be economical, advantage must be taken of full year-round heating and air conditioning. This limits the market to the field of higher-priced homes.

Commercial applications are more favored because they have a higher internal heat gain than do houses. Human beings, lights, motors, all tend to reduce winter heating load and increase summer cooling load to give a more desirable balance between loads and seasons.

A typical domestic case showed that individual cost of the heat pump is determined by a balance between summer and winter loads set at 40 F for a winter design temperature. Below 40 F the cost of equipment is determined by the summer cooling load. Tables, above, show fuel costs for heating in the northeastern and northwestern sections of the country.

With a typical commercial installation, aided by internal heat gains that maintained a temperature difference of 15 degrees, loads equalized at 12 F, winter design temperature.

The heat pump becomes competitive in regions where (1) design temperatures are moderate (2) electrical energy costs one cent or less. Operating costs based on two commercial and one residential installation showed that power was consumed at the rate of ½ to ⅔ kwhr per degree day per installed hp of compressor. *ASHVE Paper.*

State Laws Concerning Industrial Exhaust Ventilation, *by Knowlton J Caplan, Michigan Dept of Health, and Allen D Brandt, Bethlehem Steel Co.* Twenty-five states have only very general requirements concerning health conditions in industry.

Only six states have what may be regarded as a reasonably complete code or set of standards covering a number of typical operations or exhaust hood types. Two of these six require that the area of the main duct equal the combined area of all branches, plus 20%. This criterion is held to be poor and inadequate.

The authors, after concluding their analysis of the particular operations covered by codes, recommended that specific and quantitative design criteria should not be included in legislation. These should be incorporated in regulations or in advisory standards to give a greater flexibility in application. *ASHVE Paper.*

HEAT EXCHANGERS

The Effect of Baffle Height and Baffle Clearance on Heat Transfer and Pressure Drop in Heat Exchangers, *by Byron E Short, University of Texas.* Baffle height for a given weight of fluid flowing through the exchanger affects (1) velocity of fluid through the baffle opening (2) average velocity through the tube bundle (3) turbulence at the baffle and in the tube bundle.

As baffle height is increased contraction effect of the fluid stream reduces through the baffle opening but the core of the stream moves farther from the tube-bundle center. Turbulence also increases. In addition for the same fluid velocity through the baffle opening, heat transfer and pressure drop decrease with increased baffle height.

Baffle-to-shell clearance affects per-

(*Continued on page* 138)

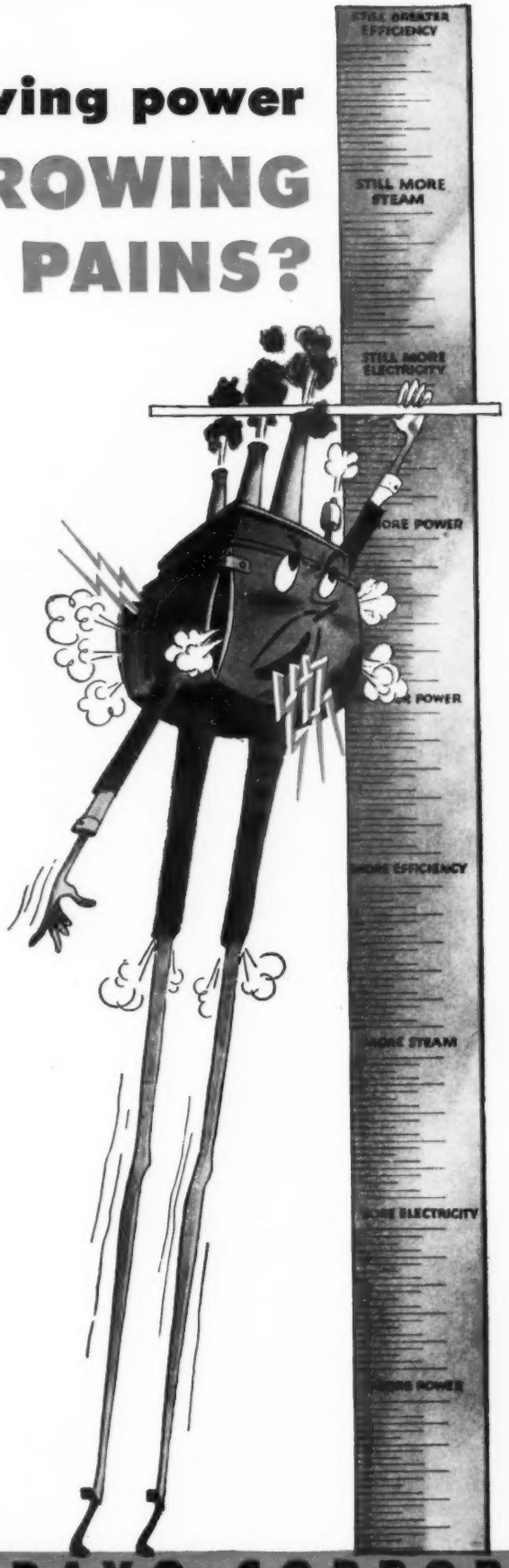
HOW TO OBTAIN COMPLETE TEXT

Material appearing in this month's briefs comes from one of these two sources:

American Society of Mechanical Engineers, annual meeting, Atlantic City, N. J., Dec. 1-5, 1947. Papers are identified by initials ASME and paper No. Available while supply lasts at American Society of Mechanical Engineers, 29 W 39th St. New York, N. Y.

American Society of Heating and Ventilating Engineers, annual meeting, New York, N. Y. Feb. 1-5, 1948. Papers are identified by initials ASHVE. Available while supply lasts at American Society of Heating and Ventilating Engineers, 51 Madison Ave, New York, N. Y.

having power GROWING PAINS?



GROWING pains of industrial expansion may be straining your power or boiler plant facilities beyond the limits of really efficient operation. Your increasing requirements may necessitate modernization or replacement of equipment to prevent plant failure.

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Coal and Ore Bridges ★ Cranes and Derrick Boats ★ Crane Cab Coolers ★ Open Steel Flooring ★ Concrete Aggregates ★ Inland River Transportation

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

Alfred Iddles, Noted as Engineer, to Head B & W

► BABCOCK & WILCOX Co directors recently elected Alfred Iddles president and chief executive officer. Widely known for engineering contributions in the power field, he succeeds A G Pratt, with the company for 45 years and president for the past 24, who becomes chairman of the board.

Long identification with the interests and problems of power-equipment users fits Iddles to carry forward progressively the activities of one of the major

ALFRED IDDLES

manufacturers in the field. A graduate of Michigan State University, he taught in the M E Dept there from 1914 to 1918, after two years of utility operating experience. As an Army captain in World War I, he had charge of power at the poison-gas plant of Edgewood Arsenal. He entered the Fuels Division of the Bureau of Mines in 1919.

Later, as vice-president of United Engineers and Constructors, Philadelphia, Iddles directed design and construction of all kinds in the U. S., Canada, and South America, gaining the broad engineering background that was to prove so valuable when he went with B & W in 1937. A vice-president since 1945, he has had charge of service and staff engineering, providing the functional design of boilers and fuel-burning units. In his many papers before power-engineering groups, he has evidenced a clear understanding of the need for designers and users to work together to solve technical problems.

W T McCullough Jr, in charge of stationary boiler sales and former Chicago office sales manager, was elected a vice-president and W G Dryden, former treasurer, was made secretary and treasurer. C W Middleton, v-p and secretary, has withdrawn from full-time service but will continue as a director and in a consulting capacity.

ASME Oil and Gas Power Conference on May 20-22

► THE 20TH ANNUAL CONFERENCE of Oil and Gas Power Div of American Society of Mechanical Engineers is to be held on May 20-22 at Hotel New Jefferson, St. Louis, Mo. This year is also the 50th anniversary of the diesel engine in America, a fitting theme around which the conference program is centered.

Registration, planned for 9:30 am on Thursday, May 20, will be followed at 10:30 am by a technical session at which papers on firing-order studies and computation of torsional-vibration systems will be presented. At the afternoon technical session, experts, drawn from large- and small-engine fields, will probe diesel engineering progress.

At technical sessions on Friday morning, diesel applications of an industrial and marine nature will be discussed. Then, in the afternoon, inspection trips are arranged, including Busch-Sulzer Bros—diesel div of Nordberg Mfg Co, St. Louis Shipbuilding and Steel Co, Fulton Iron Works, McDonald Aircraft Corp, Shell Petroleum's Research Laboratories and Aluminum Co of America.

At Saturday morning's technical session, rail application of the diesel engine and centrifugal blowers for diesel engines will be reviewed.

As in the past, there will be an exhibit of products made by leading builders of diesels and accessories.

Continuing an engineering service feature first instituted at the 19th con-

(*Continued on page* 170)

COMING EVENTS

May 6-7—Sixth Annual Anthracite Conference, Anthracite Institute and Lehigh University, held at Lehigh University, Bethlehem, Pa. A Copeland Callen, dept of mining engrg, Lehigh University, Bethlehem, Pa.

May 11-16—Engineers' Club of Philadelphia, junior members, engineering progress show, Franklin Hall in Franklin Institute of Pa., 1317 Spruce St, Philadelphia 7, Pa. Joseph J Quinn Jr, chairman, 1317 Spruce St, Philadelphia 7, Pa.

May 18-21—National District Heating Assn, 39th annual meeting, Hotel Statler, St. Louis, Mo. John F Collins Jr, secretary-treasurer, 827 N Euclid Ave, Pittsburgh, Pa.

May 30-June 5—American Society of Mechanical Engineers, semiannual meeting, Schroeder Hotel, Milwaukee, Wis. Ernest Hartford, executive assistant secretary, 29 W 39th St, New York.

June 7-10—Smoke Prevention Assn of America, 41st annual meeting, Hotel Commodore, New York, N. Y. Columbus D Behan, publicity director, 139 N Clark St Bldg, Chicago 2, Ill.

June 10-11—Prime Movers Committee, Pennsylvania Electric Assn, spring meeting, Hotel Casey, Scranton, Pa. R L Hallman, chairman, Prime Movers Committee, Pennsylvania Electric Assn, Hazleton, Pa.

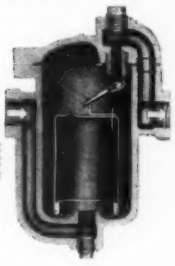
June 10-12—National Steam Specialty Club, annual meeting, The Homestead, Hot Springs, Va. Frank H Jones, secretary-treasurer of the club, c/o Schade Valve Mfg Co, Philadelphia, Pennsylvania.

June 21-25—American Institute of Electrical Engineers, summer general meeting, Mexico City, Mex. H H Henline, secretary, 33 W 39th St, New York 18, N. Y.

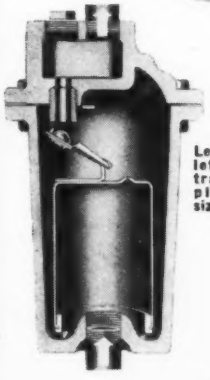
July 12-21—National Mechanical Handling Exhibition, National Hall, Olympia, London, England. Journal Mechanical Handling, Dorset House, Stamford St, London, S E 1, England.

WHY ARMSTRONG TRAP MECHANISMS *last so long!*

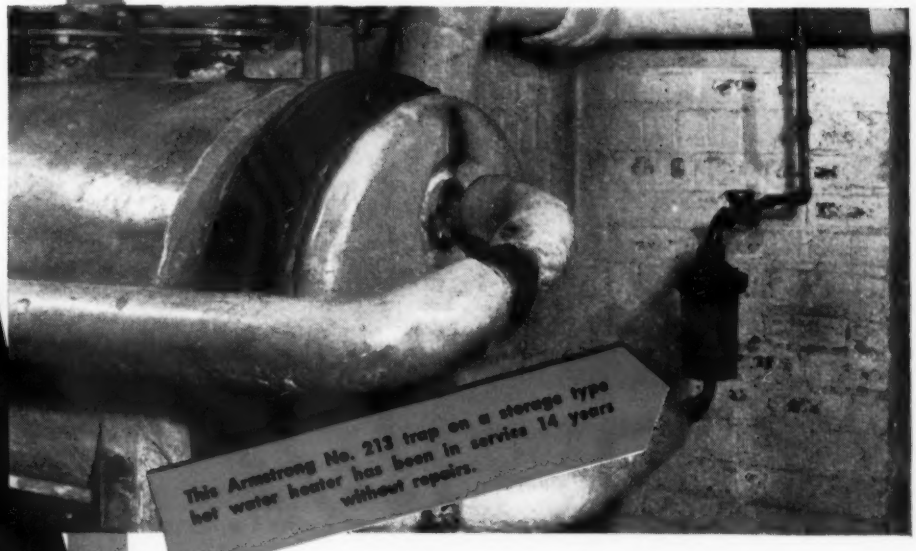
CHOICE OF BODY STYLES



Right: Side Inlet — Side Outlet traps for in-line installation.



Left: Bottom Inlet — Top Outlet traps in a complete range of sizes.



This Armstrong No. 213 trap on a storage type hot water heater has been in service 14 years without repairs.

WHAT USERS SAY

36 Armstrong Traps on heating system service in an Atlanta building still going strong without maintenance after 10 years.

* * *

One minor repair job in 20 years —that's the record of the Armstrong traps in service at South Dakota hospital.

* * *

Standardization on Armstrong traps slashed maintenance—first trap operating over 15 years without repairs—Canadian foundry.

SEND FOR the Armstrong Steam Trap Book—36 pages on trap selection, installation and maintenance. Free on request.

. . . They're built to stand 1500 psi, 1000°F

The user of standard Armstrong steam traps for medium and low pressure service reaps the benefit of the research, investment and experience that went into the development of Armstrong forged steel traps for high pressure generating station service.

The valves and seats in all Armstrong traps are chrome steel, hardened, ground and lapped to a precision fit. The inverted buckets and valve lever assemblies are all corrosion resistant 18-8 stainless, heavily reinforced for wear. In normal service these mechanisms often last for years without attention. And when a valve finally wears to the point where it fails to seat properly, it is usually good for a relapping—a job any maintenance man can do in a few minutes. Or replacement is a simple, inexpensive job.

It's this built-in quality of Armstrong traps that keeps them on the job without leaking steam, without sticking or clogging, without frequent maintenance. Quality pays dividends when it comes to steam traps. Plan now to standardize on Armstrong, the *quality* traps. Call your Armstrong representative or write:

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ARMSTRONG · INVERTED BUCKET · STEAM TRAP

ARMSTRONG STEAM TRAPS

A LESSON IN ADVANCEMENT

The all-time great billiards player Willie Hoppe was once asked the secret of his success, because, even though over 60, he keeps winning all the major tournaments. His answer was, "My competitors play Willie Hoppe—I play billiards."

The winner in any profession or undertaking follows this same rule: first learn and master all the requirements of the job before starting to fret about whether the fellow at the next desk is getting too far ahead.

I recall one large plant where one of the brightest engineers I ever met got himself fouled up by not paying enough attention to the demands of his work. He had education, brilliance, experience, he met people well—we all thought he couldn't miss being the Plant Engineer one day. But it turned out he had a serious failing: he spent a lot of time trying to figure out how he could convert things his associates said or did to his own advantage.

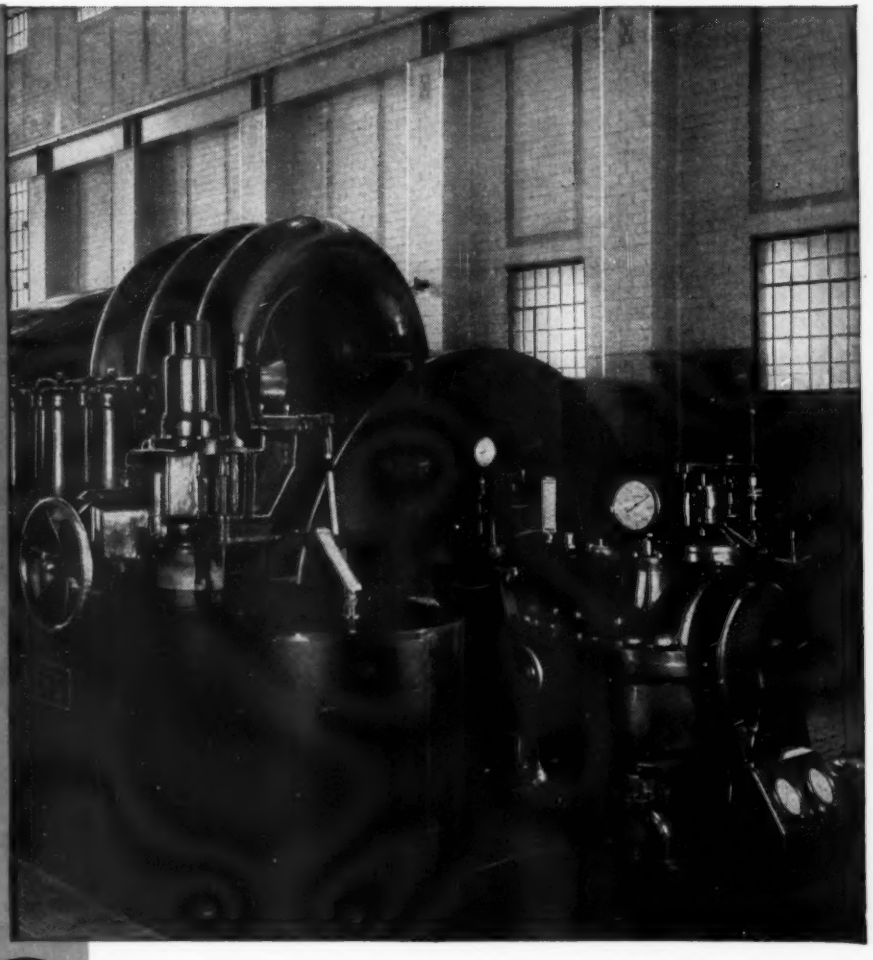
Apparently, he couldn't resist the mental stimulation of playing "chess" with the plant organization. He'd set up all sorts of probable moves for the people working alongside and immediately above him, so he could be "ready" to move up in case somebody should be transferred or promoted.

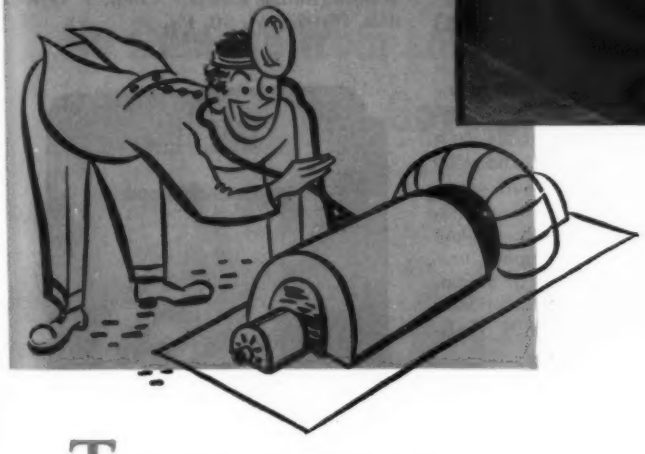
It wasn't too long before the Boss discovered that this fellow's production was below his capabilities, and eventually he "moved on" to another job. I'm still not sure, though, that he learned this lesson: *it's more important to stay ahead of your job than to stay on top of your associates.*

George Edwards

Engineer

Protect The Heart of Your Turbine





Assure instantly responsive governor action by keeping the lubricating system free of rust and varnish. Use *Texaco Regal Oils (R & O).*

TEXACO *Regal Oils* (*R & O*) give both governor and the entire turbine system an extra margin of safety. They are, in fact, the world-famous Texaco Regal Oils *improved* with rust and oxidation inhibitors and processed to prevent foaming. They keep lubricating systems clean and bearing temperatures normal . . . give extra long service life.

Turbine manufacturers recommend the use of inhibited oils—especially in new turbines. *Texaco Regal Oils* (*R & O*) meet the stringent requirements of all leading turbine builders . . . as well as the turbine oil specifications of the U. S. Navy.

A Texaco Lubrication Engineer will gladly tell you more about *Texaco Regal Oils* (*R & O*) and other Texaco products for power plant lubrication. Just call the nearest of the more than 2500 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

Tune in . . . Texaco Star Theatre every Wednesday night featuring Gordon MacRae and Evelyn Knight . . . ABC Network

joint guards against overloading.

Standard feeder comes in 20-ft lengths. Capacities range from few hundred to several thousand lb per hr. An agitator is available for use with fine and "wet" coals. **Hager Bros, East PO Box 1511, Rockford, Ill.**

Regulating Valve E160

AIR WARDEN automatic pressure-regulating valve is for use on initial or primary air pressures up to 150 psi, and can be set to maintain reduced pressures ranging from 125 to 5 psi. Valve has built-in fine-mesh bronze strainer, instrument-type control knob for pressure adjusting, nylon valve seat, textile reinforced synthetic rubber diaphragm, and built-in pressure gage. The *Air Warden* is produced in two models: Model *RD*-1 is for ⅜-in. piping, and Model *RD*-2 is for ½-in. connections. **Hannifin Corp, 1101 S Kilbourn Ave, Chicago 24, Ill.**

Vibrating Feeder E161

ELECTRIC-VIBRATING FEEDER has an enclosed power unit for installations where the material is magnetic, hot, dusty and abrasive. In addition to being dust tight, it is also provided with air-inlet and outlet features. Thus a stream of air circulates through the motor and if necessary builds up a slight pressure that acts as double insurance toward keeping dust out. This power unit has adjustable supports that allow for changing the feeder slope from 5 deg upgrade to 15 deg downgrade, by loosening four capscrews on the support, and raising or lowering the deck end to suit. **Jeffrey Mfg Co, Columbus 16, Ohio.**

Hand-Powered Cutters E162

REDESIGNED LINE of hand-powered cutters have curved toe-in handles, broad, rounded palm-fit grips, no protruding screws or bolts, metal safety handle stop, 30% greater tool strength in sections and handles, jaws plainly marked showing capacity and type of metal safely cut. Will cut bolts, rods, wire, cable, chain, bars and metals of all kinds. **H K Porter, Inc, Somerville, Mass.**

Portable Repair Shop E163

HANDY-MATIC PORTABLE REPAIR SHOP is completely equipped for on-the-spot repairs. Power is supplied by a ½-hp motor for 110- or 220-v, 60 cycles, ac, with a flexible shaft drive. Available for 1400, 2400, and 4500 rpm with V-belt drive. Tools and accessories include attachments for sanding, drilling, wire brushing, grinding, buffing and sawing metal or wood. Complete unit weighs 100 lb, and is contained in a compact cabinet mounted on three caster legs. **Wyzenbeek & Staff, Inc, 838 W Hubbard St, Chicago 22, Ill.**

Lamp Capacitor E164

FOR POWER-FACTOR IMPROVEMENT of fluorescent lamps, these capacitors are listed by Underwriters' Laboratory, Inc, as meeting their requirements for correcting power factor of low power-factor ballast. These *Solar FF* fluorescent condensers are available in three ratings for operation at either 118, 208 or 236 v, 50-60 cycles, ac. Used singly or in recommended combinations, these capacitors will assure 85% power factor, or better. **Solar Capacitor Sales Corp, 1445 Hudson Blvd, North Bergen, N. J.**

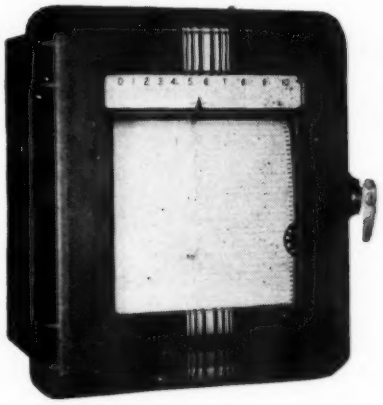
Adjustable Troughing Idler E165

TROUGHING IDLER outer-inclined pulleys are adjustable from slightly above the horizontal up to an angle of 25 deg. All idler pulleys are in same vertical plane and adjustment of outer pulleys is made to maintain a constant gap between ends of horizontal and inclined pulleys. This gap is kept to a minimum to prevent creasing or pinching the belt.

Idler is for use on conveyors where inclined belt changes to a horizontal path, and at the feed and discharge ends of belt conveyors to allow the belt to be troughed or flattened gradually. This reduces strain on the belt by eliminating abrupt distortion of it when entering or leaving idlers. **Koppers Co, Pittsburgh 19, Pa.**

Level Indicator E166

MAGNETIC TYPE INSTRUMENT for liquid-level indication consists of two separate independently replaceable assemblies, each oil-tight and weatherproof, so that it is impossible for fluid to reach or affect the scale. Outer assembly includes the calibrated dial and indicating needle, which is directly mounted on a shaft carrying a permanent magnet. The body is a sealed unit enclosing another magnet directly coupled through a shaft to float arm. Any motion of float arm rotates body magnet, which in turn displaces outer magnet and indicating needle. Instrument can be furnished with contact for low-level alarm. **Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa.**



Oxygen Recorder E167

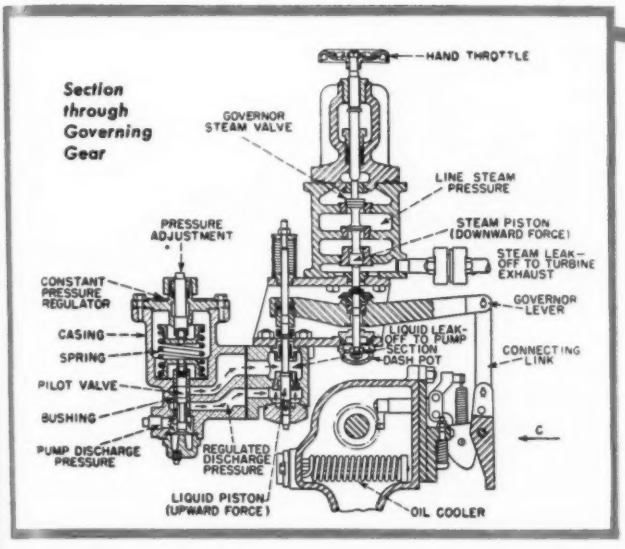
MICROMAX OXYGEN RECORDER checks on boiler combustion efficiency and serves as a guide for regulating excess air in furnaces such as glass tanks, cement kilns, and open-hearth furnaces. Instrument operates on thermal conductivity principle. Oxygen analysis is by the hydrogen-difference method, which consists of adding hydrogen to gas sample, removing oxygen by combustion, and electrically comparing conductivity of sample before and after oxygen is consumed. Instrument is available with a round- or strip-chart recorder. **Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.**

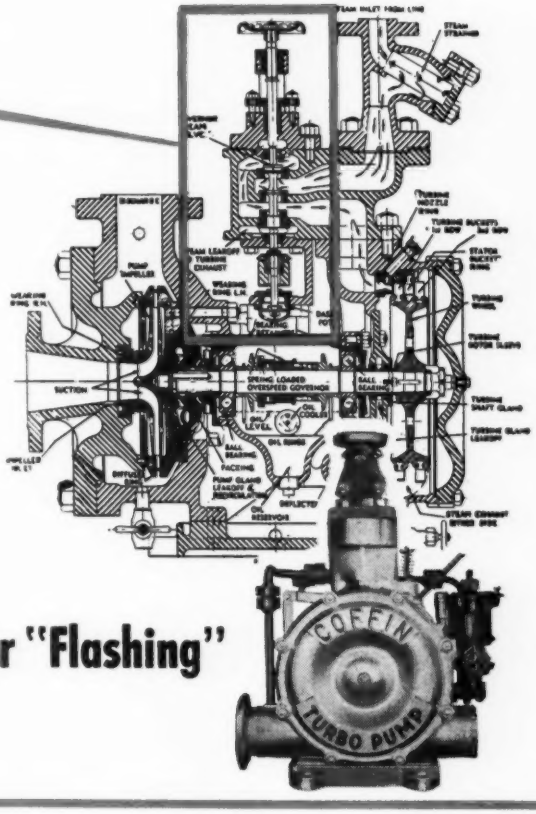
(*Continued on page* 158)

Use convenient reply cards on page 176a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

COFFIN TURBO PUMPS

HIGH SPEED • SINGLE STAGE





5 No Damage from Loss of Suction or "Flashing" with the Coffin Governing Gear

Loss of suction empties the pump impeller, and discharge pressure drops. *Upward* liquid force diminishes and *downward* steam force throttles Governor Steam Valve, reducing rotor speed. With recovery of suction impeller fills, discharge pressure rises, and *upward* force opens Governor Steam Valve, restoring speed and output.

Standardized Boiler Feed Units for:

Steam Pressures to 650 PSI
Steam Temperatures to 850 F
Back Pressures to 60 PSI

Pump Capacities to 500 GPM
Discharge Pressures to 750 PSI (Heads to 1800 feet)
Liquid Temperatures to 300 F

UNIQUE FEATURES

1. Standardized Steam Turbine Centrifugal Pump and Governor Sets, individually engineered, assembled, and tested for IMMEDIATE SHIPMENT.
2. No destructive casing erosion-corrosion.
3. No interstage leakage.
4. Wide range exact pressure governing.
5. Loss of suction reduces speed without tripping; automatic speed recovery with suction restoration.
6. High efficiency pump plus high speed two-bucket row turbine result in minimum steam consumption.
7. Matched Pump, Turbine and Governors under one responsibility.
8. Exact hydraulic and mechanical balance—light weight rotor—large bearings; result: bearing troubles practically unknown.
9. Pump Gland Leakoff provides adequate recirculation; suction pressure only on packing.
10. Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation.
11. All parts made to gage and replaceable without fitting; all parts in stock at factory with wearing parts available from agencies' stocks.
12. Proved for performance over a period of more than twenty years in service.
13. Compact, light in weight, quiet and low in maintenance.

Literature sent on request; specific proposals on receipt of operating data.

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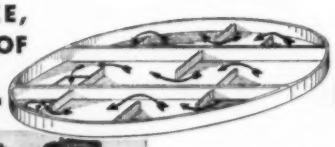
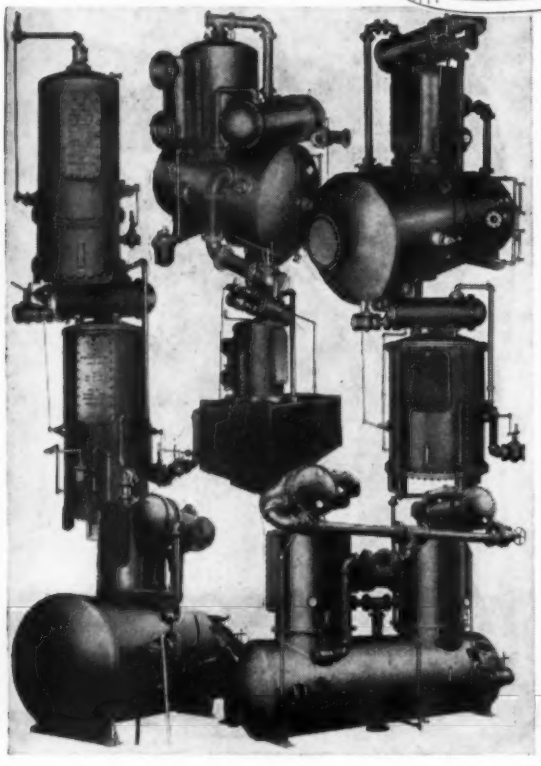
Cost-Reducing Performance

IN ANY TYPE, SIZE, OR CONSTRUCTION OF

STICKLE **OPEN COIL** HEATER





STICKLE HEATERS

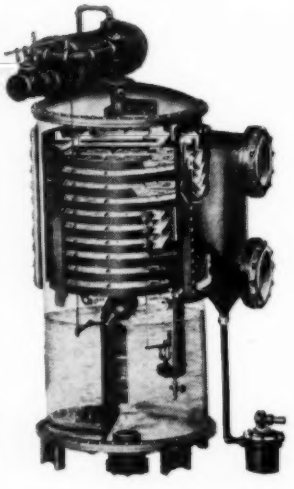
—supply greater heating capacity in less space.

—provide makeup water for boilers with non-condensable gases eliminated and scale-forming substances depleted.

—add steam condensed in heating raw water to boiler feed supply, making one-sixth of makeup distilled water.

—afford continuous, trouble-free service, with long life.

Raw water, entering heater from top, is in direct contact with steam, which fills heater shell, throughout course of travel. Flowing in thin, animated film and dropping from tray to tray, heat from steam is rapidly transferred and feedwater is delivered to pump at temperature of saturated steam in heater.



• Whether requirements call for a small or an extremely large volume of preheated and purified water, there is a Stickle Open Coil Heater to meet the need—in Deaerating or Non-Deaerating Type, in Cast Iron or Steel Construction, with standard or special storage capacity. A few examples are shown above. Stickle Heaters are adaptable to space and other conditions of installation, and are alike in simplicity of design, in functioning efficiency, and trouble-free operation. Bulletin No. 117, on request, gives additional information.

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Successfully Serving for More than 40 Years Paper Mills, Food Processors, Textile and Hosiery Mills, Laundries and Other Manufacturers Using Steam for Industrial Processing

STICKLE EQUIPMENT

STICKLE DIFFERENTIAL AND BOILER RETURN SYSTEMS • STICKLE OPEN FLOAT STEAM TRAPS • STICKLE REGULATING AND REDUCING VALVES • STICKLE OPEN COIL FEED WATER HEATERS AND PURIFIERS • STICKLE OIL AND STEAM SEPARATORS STICKLE TEMPERATURE CONTROLLERS AND OTHER SPECIALTIES

Technical Briefs

(*Continued from page* 130)

centage of fluid mass passing through the tube bundle. It follows that an increase in clearance produces a decrease in heat transfer. Further, both pressure drop and turbulence losses decrease because contraction and expansion effects decrease. *ASME Paper No. 47-A-105.*

Heat Transfer and Fluid Friction During Viscous Flow Across Banks of Tubes, *by G A Omohundro, O P Bergelin, A P Colburn, University of Delaware.* A cooperative Heat Exchanger research project, sponsored by the ASME and conducted by the University of Delaware along with manufacturers and users of heat exchangers, forms the material for this report.

Suitable equipment for rapid and accurate testing of models is described. Heat-transfer coefficients during cooling, and pressure-drop data during both isothermal and cooling runs are furnished for low velocities, chiefly in the viscous region, over an unbaffled bank. *ASME Paper No. 47-A-102.*

A Study of Flow Patterns in Baffled Heat Exchangers, *by S Kopp, H R Sennstrom, A Y Gunter, American Locomotive Co.* For the experimental study of fluid-flow patterns, smoke has been generally accepted as the best available measuring means for many years. A colloidal suspension of Bentonite in water and powdered aluminum in water, to which a wetting agent has been added, have come to the fore within recent years for tests of this nature.

This latter method was employed on two-dimensional models in the tests reported in this paper. Studies of these tests indicate possible improvements in side baffling of shell-and-tube heat exchangers. *ASME Paper No. 47-A-103.*

Frequency Response Measurements of a Hydraulic Power Unit, *by M Russell Hannah, Sperry Gyroscope Co, Inc.* Where high-performance power sources are required in servomechanisms hydraulic-power units continue as important elements. For this class of service fidelity of the power unit in response to controlling signals carries considerable importance with the servo designer. He gets this information from experiment, or it is corroborated by experimental data.

This report outlines an investigation into the dynamic response of a typical

FAIRFIELD

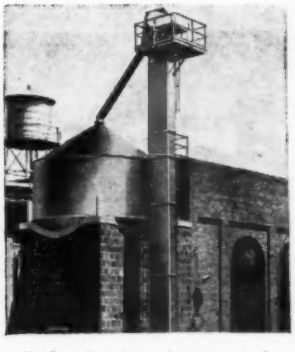
COAL *and* ASH HANDLING EQUIPMENT *is well represented HERE!*

Bucket Elevator discharging to ground storage.

The name of FAIRFIELD has been linked with "Who's Who" in American Industry for years. Many of these prominent companies have installed FAIRFIELD designed, built and erected Coal and Ash Handling systems. Many of them who have either outgrown the original Fairfield installation or built new plants have chosen FAIRFIELD again and again to apply its practical engineering knowledge and "know how" to the important subject of low cost, efficient coal and ash handling. This is significant! It reflects a confidence that must be born of a seasoned understanding of the needs of each individual plant and a successful solution.

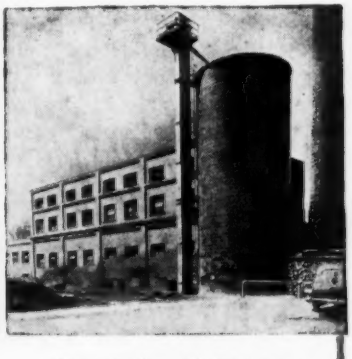
FAIRFIELD invites your confidence. Whether you are planning an extension to your present plant or a new one, Fairfield Engineers would welcome the opportunity to discuss the automatic handling and storage of coal and ashes. Rest assured a Fairfield recommendation will be made with maximum operating economy in mind. Write us today.

Skip hoist and 200 ton cylindrical bunker.



Bucket elevator and 100 ton cylindrical bunker.

Chutes to stokers from outside silo.



300 ton tile silo and bucket elevator.

The FAIRFIELD ENGINEERING COMPANY

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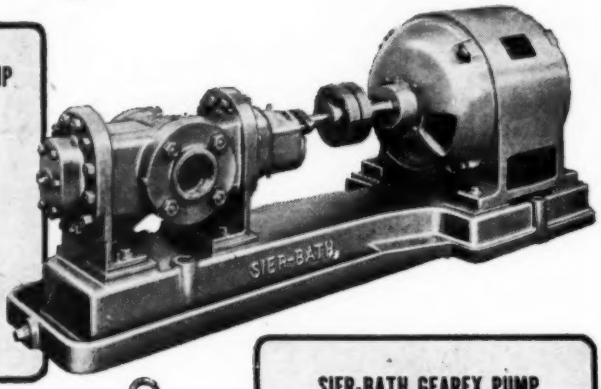
327 CHICAGO AVENUE • • • • • MARION, OHIO, U. S. A.

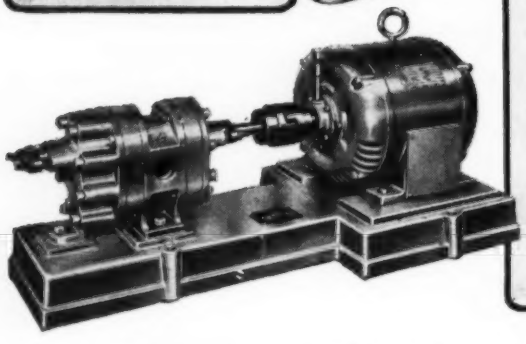
ONE PUMP working on the job is worth a dozen in the repair shop!

SIER-BATH SCREW PUMP

Advantages: • pulseless flow • anti-friction bearings • vibrationless operation • low maintenance cost • rugged construction.

Pumps: Acetate, asphalts, brines, Bunker C Fuel Oil, Cellulosics, Greases, Molasses, Syrups, Lube Oils, etc.





SIER-BATH GEAREX PUMP

• Balanced Axial Thrust • Pulseless Flow • Vibrationless Operation • Roller Bushings for Precision Running under load.

Pumps: Oils, Varnishes, Solvents, Molasses, Chemical Solutions.

Capacities: 1-550 g. p. m.

Discharge: 250 p. s. i. for medium or high viscosities. 50 p. s. i. for water.

The most notable point about SIER-BATH Screw Pumps and Gearex Pumps is their relative freedom from maintenance.

THERE is no mystery about the ability of Sier-Bath Pumps to stand up under the most trying conditions. After all, in such pumps, the worms and gears are the most important parts. And when you consider that Sier-Bath Pumps are made in the best equipped precision gear shop in the country, it is easy to understand their exceptional dependability. Their pulseless flow and vibrationless operation greatly reduce maintenance cost—there is much less wear on valves, couplings and other fittings. Pipes and joints remain tight. With labor costs at their present high figures, these are important points to consider in pump selection. Send for descriptive booklet.

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hydraulic-power unit comprising a transmission and associated-stroke control. Frequency analysis acts as the tool for investigating effect of certain system parameters upon the performance of several power-unit components. *ASME Paper No. 47-A-70.*

Low-Pressure Steam-Heated Distilling Plants, *by A M Impagliazzo, R M Bent, Griscom Russell Co.* The advent of relatively high steam pressures in marine power plants superimposes a need for extremely pure feedwater on the old problem of supplying merchant vessels with pure water. Distillation by means of low-pressure steam-heated distilling plants offers advantages from both engineering and economic standpoints.

This paper discusses these advantages. It touches on recent literature covering the economic side and then goes into the various equipments suited for distillation. *ASME Paper No. 47-A-86.*

Analysis of Tests on Positive Displacement Meters for Liquid Hydrocarbons, *by E E Ambrosius, Pennsylvania State College.* Characteristics of displacement-type mechanical meters when measuring liquid hydrocarbons constitutes the subject of this paper. It is a continuation of an earlier paper. Included are amplification of results and a method of analysis of data from tests conducted by the ASME special Research Committee and the American Petroleum Institute Topical Committee on Volumetric Research. *ASME Paper No. 47-A-72.*

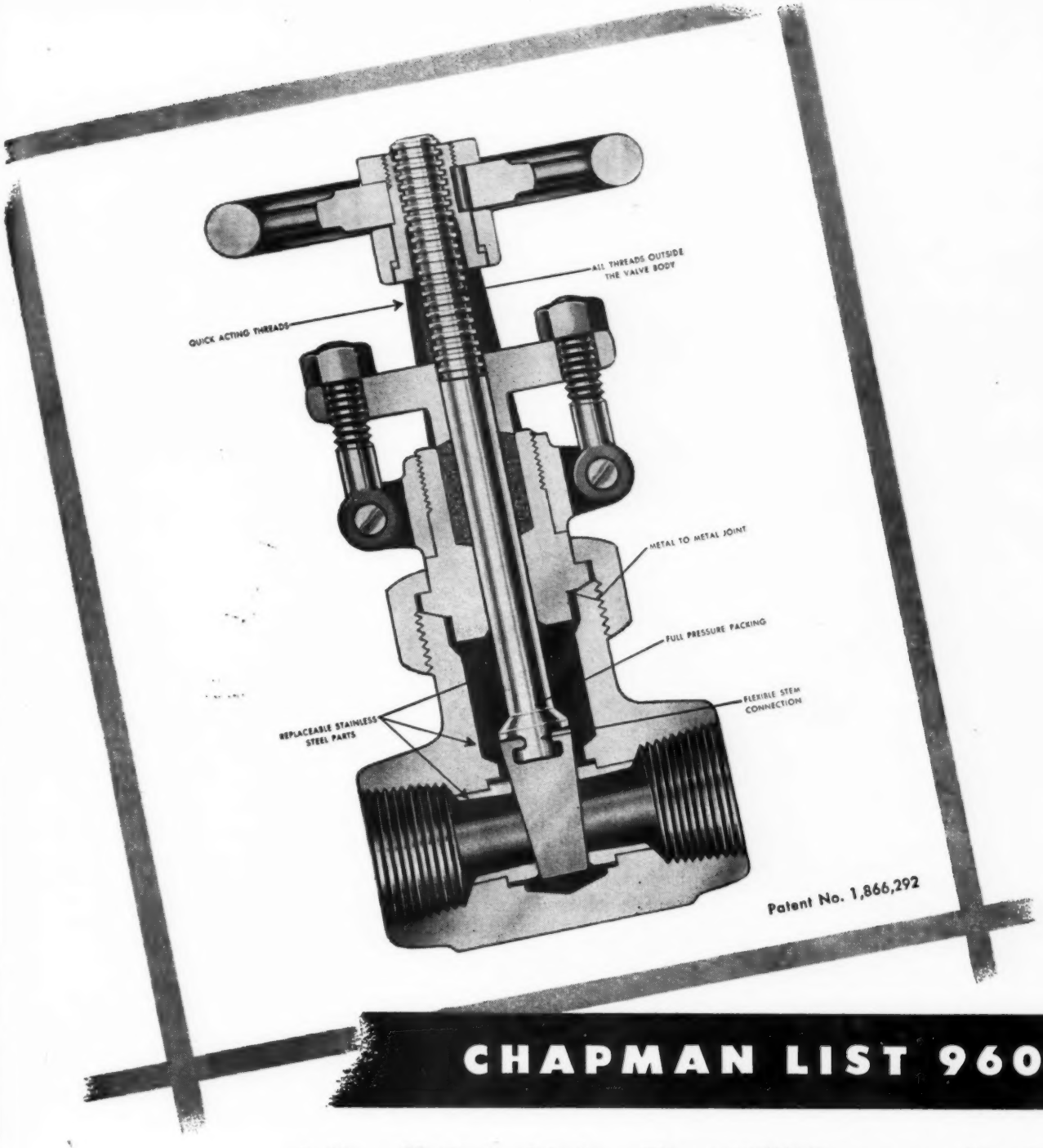
Flow in Conductors

(*Continued from page* 108)

through the circuit. In practice, however, even a small current requires a coordinated drift of an inconceivable number of electrons. For example, in a continuous flow of one ampere, 6.3-billion electrons pass a given point in a circuit each second. This is known as an ampere-second or coulomb.

The little electron can be accused of responsibility for practically all electrical phenomena. All neutral bodies, that is those that do not manifest an electrical charge, have an equal number of electrons and protons in their structures. When a body has more electrons than protons it has a negative charge. Conversely, if a body is deficient in electrons it is positively charged.

Positive and Negative. It should be



CHAPMAN LIST 960

A Small Gate Valve That Will Stay on the Job

Here is a compact forged steel gate valve so ruggedly built that it practically eliminates the maintenance and replacement problem. Because no pressure is transmitted to the stem, it can be repacked under full pressure. Its quick-acting threads will not stick or freeze. It is supplied with super-hardened seats and plugs for extra severe services.

Made in sizes from $\frac{1}{4}$″ to 2″— carbon steel for pressures to 800 pounds; alloy steels for pressures to 1000 pounds at 750° F. For higher pressures, specify List 990.

The Chapman Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

This beats a magic carpet!

Air Express can bring you supplies and equipment from any U.S. point—*overnight*. And that's better than old-style magic! Air Express is the fastest way you can find to ship or receive. No delays, because shipments go on every flight of the Scheduled Airlines.

What's more you get special door-to-door service at no extra cost. With low Air Express rates, you can use this fastest service as a regular procedure. Let Air Express keep your business running fast—and smoothly.

Specify Air Express-World's Fastest Shipping Service

- Low rates—special pick-up and delivery in principal U.S. towns and cities at no extra cost.
- Moves on all flights of all Scheduled Airlines.
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True case history: Rubber equipment users regularly get replacement parts by Air Express so machines won't stand idle. Recent shipment: 102-lb. carton picked up 5 P.M. the 18th in Noblesville, Ind. Air-rail to Dallas, delivered 9 A.M. following day. 799 miles, total cost only $26.78. Any distance inexpensive, too. Phone local Air Express Division, Railway Express Agency, for fast shipping action.

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made clear that adding electrons to or taking them away from an atom does not change it chemically, but only gives it a negative or a positive charge. Fig. 11 shows an oxygen atom with eight electrons in its two orbits, and eight protons and eight neutrons in its nucleus. This is the natural state. The negative electrical charges on the eight electrons equal the positive electrical charges on the eight protons to make the atom electrically neutral.

If the atom lost an electron it would then have only five in its outer orbit, Fig. 12. The atom, having only seven electrons, one less than the number of protons in the nucleus, is given a positive charge, or has become a positive ion.

On the other hand assume the atom, Fig. 11, picks up an electron. It then has seven in its outer orbit or a total of nine, Fig. 13. The atom now has one electron more than it has protons, consequently has a negative charge, or is a negative ion. That is, a negative ion is an atom that has gained an electron, whereas a positive ion is an atom that has lost an electron.

Note that all the changes in the electrical charge on the atom are due to a gain or loss of an electron, not a change in the number of protons in the nucleus. These are bound in the nucleus with tremendous energy and their number remains constant in the atoms of each element, even though the number of neutrons may change.

Accordingly, we may draw the conclusion that if we add electrons to a neutral body it becomes negatively charged and if we rob it of electrons it becomes positively charged or ionized. This is just what happens under many conditions. For example, when a glass rod is rubbed with a piece of silk the glass becomes positively charged and the silk has a negative charge.

This means that some of the glass atoms gave electrons to the silk, so that the silk has an excess and the glass a deficiency of electrons. The electric charges were not caused by friction between the silk and glass rod, because friction does not create electricity. The rubbing brought the silk into sufficiently close contact with the glass to permit electron migration from one substance to the other.

After a glass rod has been given a positive charge it will attract bits of paper if it is brought near them. This occurs because unlike charges repel and like charges attract. When the positively charged rod is brought near a bit of paper it attracts some of the electrons in the paper, as indicated in

EXTRA YEARS OF
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LOWER PIPING COSTS

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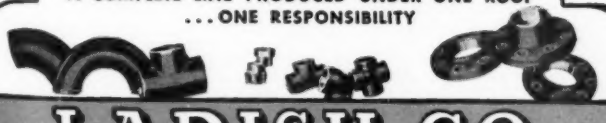
SEAMLESS WELDING FITTINGS

Your operating statements for years to come can reflect worth-while savings in piping costs . . . if you standardize now on Ladish Controlled Quality Seamless Welding Fittings.

Unsurpassed laboratory control of forging processes assures a fine, uniformly compact grain structure in Ladish fittings that provides maximum dynamic strength and toughness while rigid control of metal properties gives added protection against brittleness and distortion at temperature extremes. Only fittings of such metallurgical integrity can give you the economy of long trouble-free service.

A COMPLETE LINE PRODUCED UNDER ONE ROOF
. . . ONE RESPONSIBILITY



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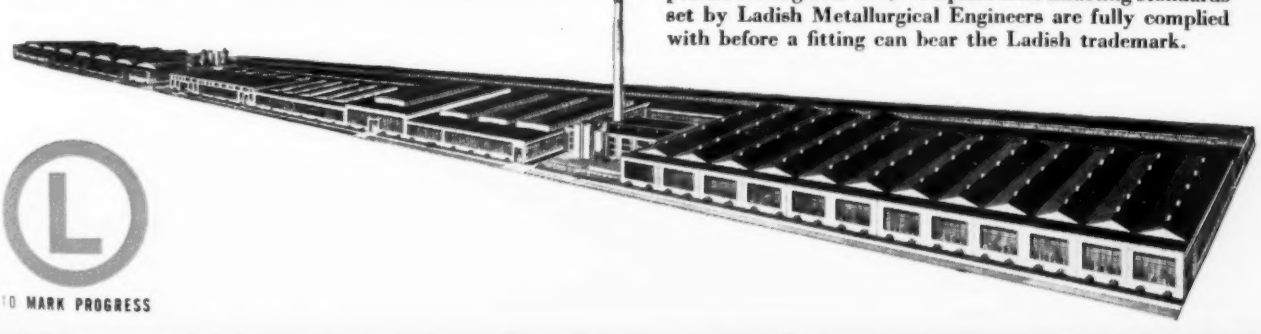

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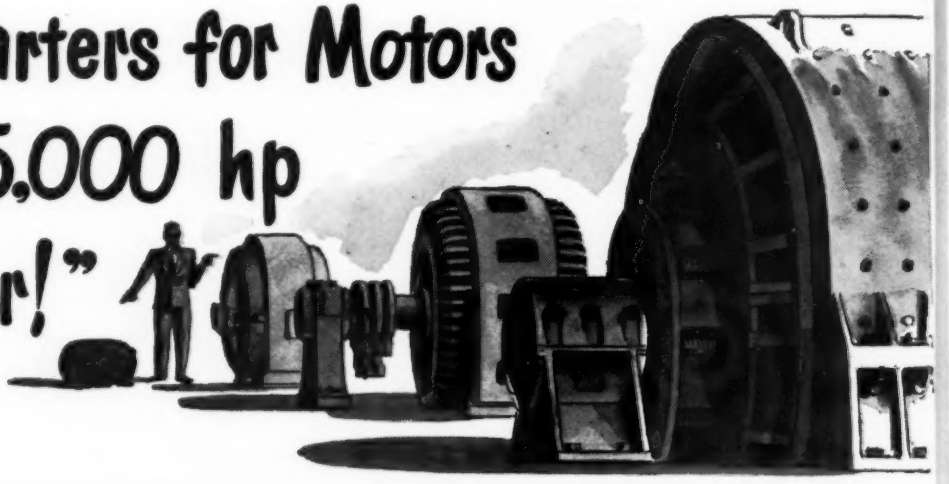

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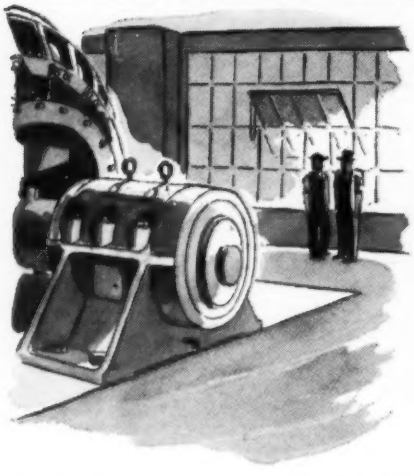

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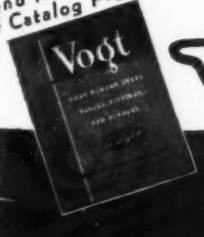

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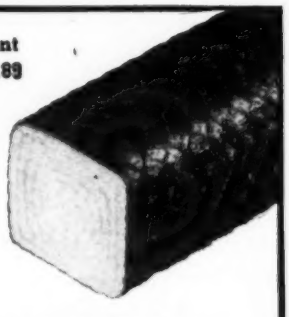

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Fig. 14. This action gives the paper nearest the rod a negative charge and it is attracted by the rod.

Rubbing a stick of sealing wax with cat's fur causes electrons from the fur to migrate to the wax. It becomes negatively charged whereas the fur assumes a positive charge. If the end of the sealing wax is brought near bits of paper it will attract them. In this case the negative charge on the wax repels some of the electrons in the near edges of the paper. This part of the paper then has a positive charge, as in Fig. 15, and is attracted by the negative charge on the wax.

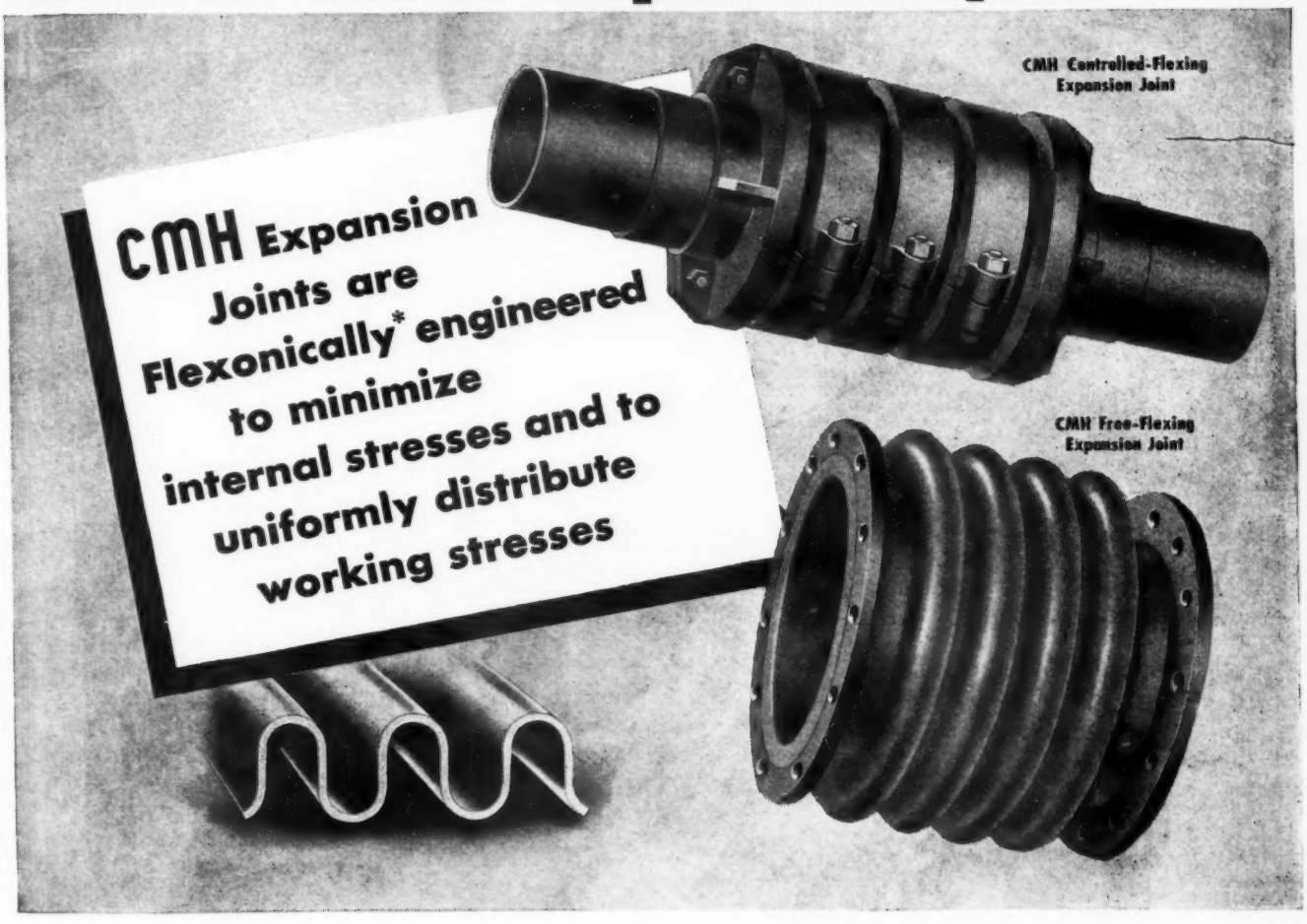
When you walk across the carpet in a dry room and reach out to touch a radiator your fingertips get a shock as they come near the radiator. This shows that your body becomes electrically charged by the action of your feet on the carpet. What really happens is that your shoes pick up electrons from the carpet and your body becomes negatively charged. When you touch the radiator your excess electrons flow into it and to the earth to establish again a balance between electrons and protons in your body and "put you at peace with the world." This process seems to be going on in all substances, electrons moving from a substance that has an excess to one that has a deficiency.

As already mentioned, like electrical charges repel and unlike charges attract. A simple experiment proves this theory. Support each of two pith balls from the end of a silk thread and touch each with a glass rod after rubbing it with silk. This gives each ball a positive charge because the positively charged rod robs the pith balls of some of their electrons to help make up the deficiency on the glass rod. If the pith balls are now brought together they repel each other. Similar results are obtained if the pith balls are touched with a sealing-wax stick, after being rubbed with cat's fur. In this case the pith balls are negatively charged and repel each other, because some of the excess electrons on the sealing wax hopped onto the balls and left them with an excess.

If one of the pith balls is touched with the glass rod and the other with the stick of sealing wax the balls have opposite charges and attract each other. These simple experiments show how electrons try to get away from a spot where there is an excess to one where there is a deficiency.

References. The simple concepts of electrons and the structure of matter, given in this and the April issue, are

Here is the CMH contribution to maximum expansion joint life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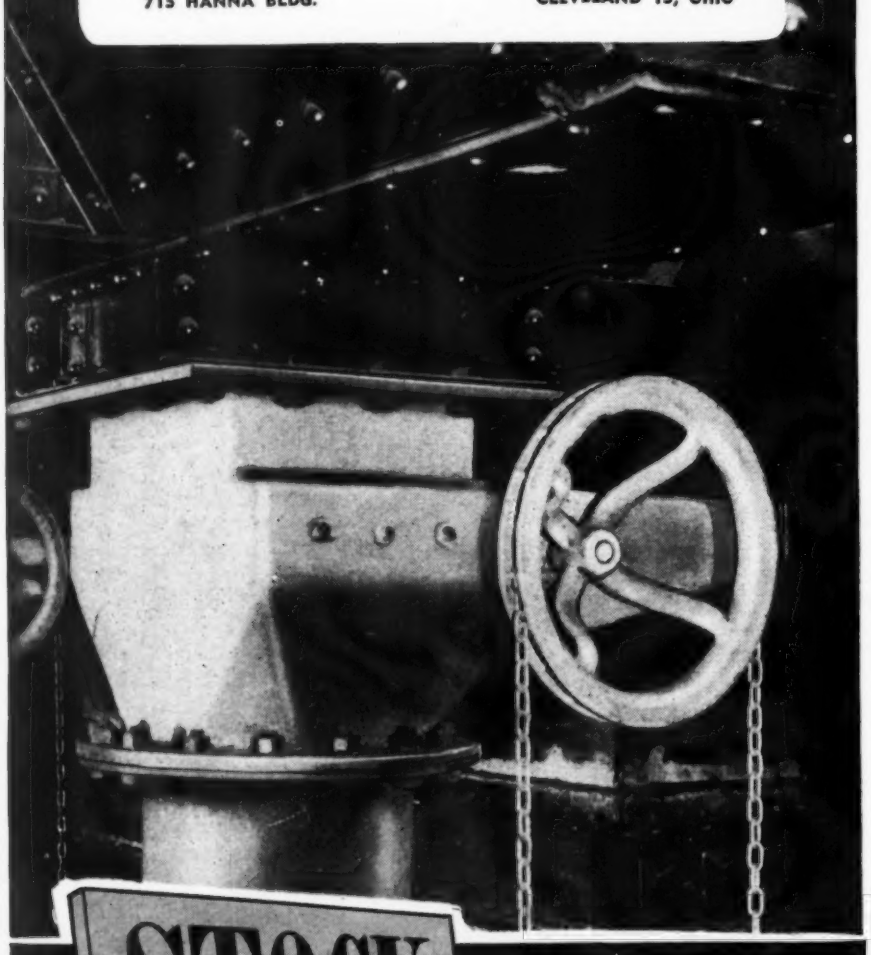

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necessary background for understanding construction and operation of electron tubes and their applications. Some good books for further study are: *Electron Tubes and Their Applications*, by John H Morecraft; *Principles of Electronics*, by Royce G Kloeffler; *Electronics for Industry*, by W I Bendz —all published by John Wiley & Sons, New York, N. Y. *Fundamentals of Vacuum Tubes*, by A V Eastman; *Electronics in Industry*, by G M Chute; *Electron Tubes in Industry*, by Keith Henney; *General Chemistry*, by John A Timm—all published by McGraw-Hill Book Co, New York. *Electronics for Electricians and Radio Repair Men*, published by Coyne Electrical School, Chicago, Ill.

Plant Problems

(*Continued from page* 116)

2 is being emptied, cylinder 3 is exhausting, cylinders 4 and 5 are curing, and cylinder 6 is cooking. Here is a definite sequential operation. During the 12 hours, 1 cylinder is always being emptied, another filled, 1 cylinder is exhausting, 2 are curing, and 1 is cooking. This keeps a filling gang and emptying gang going for the entire 12-hour period. It also makes available exhaust steam from one cylinder or another during the same period.

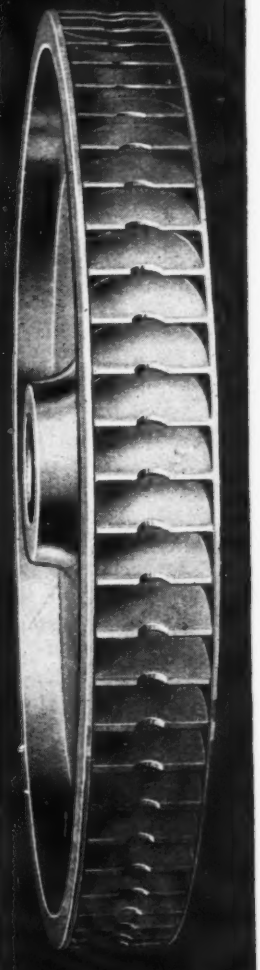
This arrangement is not fixed but is merely suggested to show *HW* what proper study of his problem will do. The arrangement is flexible and he can set up a sequence to suit plant conditions.

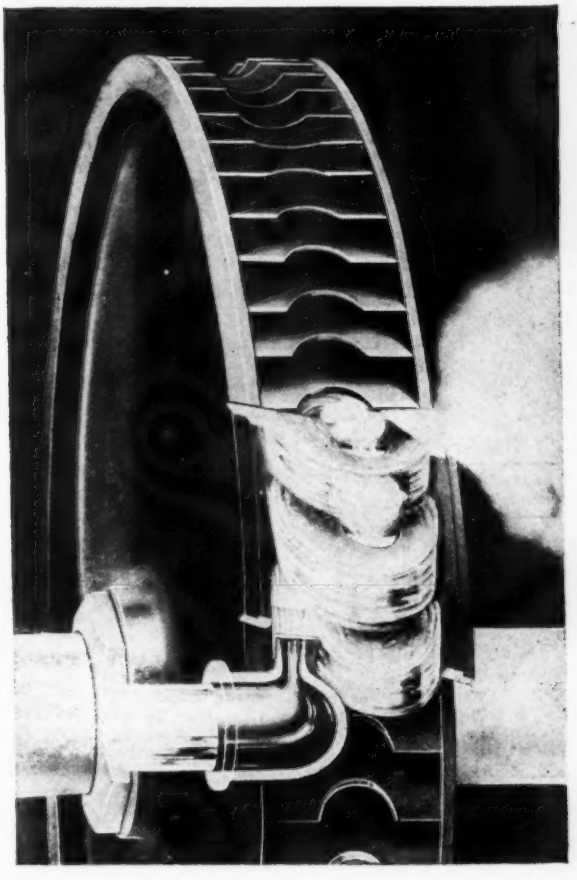
He will probably have to modify his existing piping installation if economy shows it is worth while. Note, too, that I have extended the exhaust period from 40 min to 2 hr. This can be done by proper throttling. Now *HW* can use the exhaust steam to advantage to heat the feedwater, and this would be available throughout the 12-hour period. Allowing two hours for filling and two for emptying includes a rest period, which the men will welcome. **K B Hoffman, Tenafly, N. J.**

Reconnect Injector

HW's FIRST STEP is to have steam from his curing cylinders analyzed to check its possible use for heating feedwater in an open feedheater or hotwell tank. If steam contains harmful material that causes scale in boilers and feed lines, the only alternative is to pass it through

TERRY





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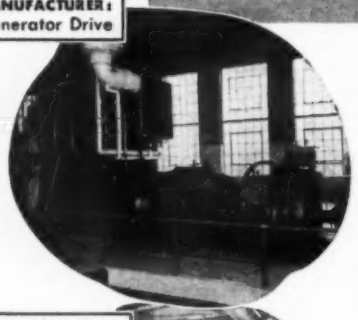
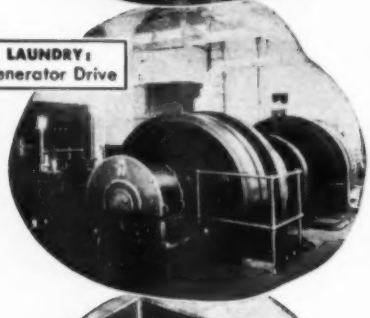


BREWERY: Compressor Drive

LAUNDRY: Generator Drive



PUBLIC INSTITUTION: Generator Drive

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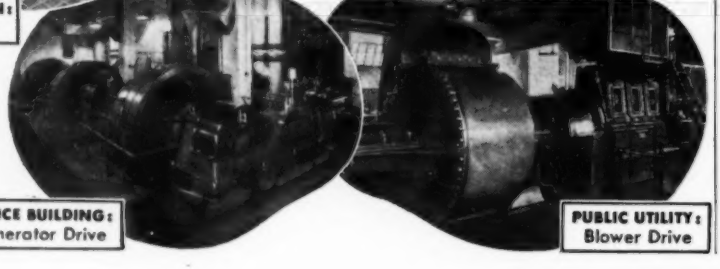


OFFICE BUILDING: Generator Drive

PUBLIC UTILITY: Blower Drive

either a coiled tank or concrete sump.

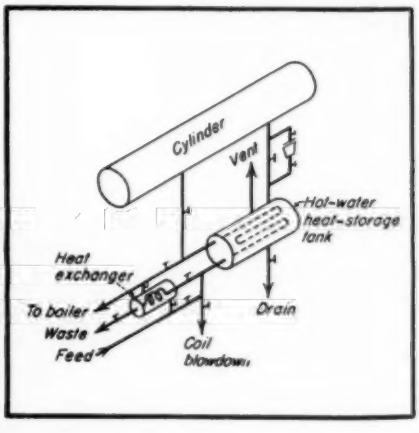
Feeding cold water into a boiler is prohibited by boiler safety laws, as the severe strains on the boiler shorten its life. Most laws state that water colder than 120 F shall not be fed to a boiler. An open-type heater may be a good investment for *HW's* plant. Since some exhaust steam is available, this can be supplemented by live steam through a reducing valve, when exhaust is not sufficient to heat feedwater. An open heater soon pays for itself by saving fuel and reducing boiler strain. *HW* should consult a feedwater heater manufacturer as to the best type for his plant.

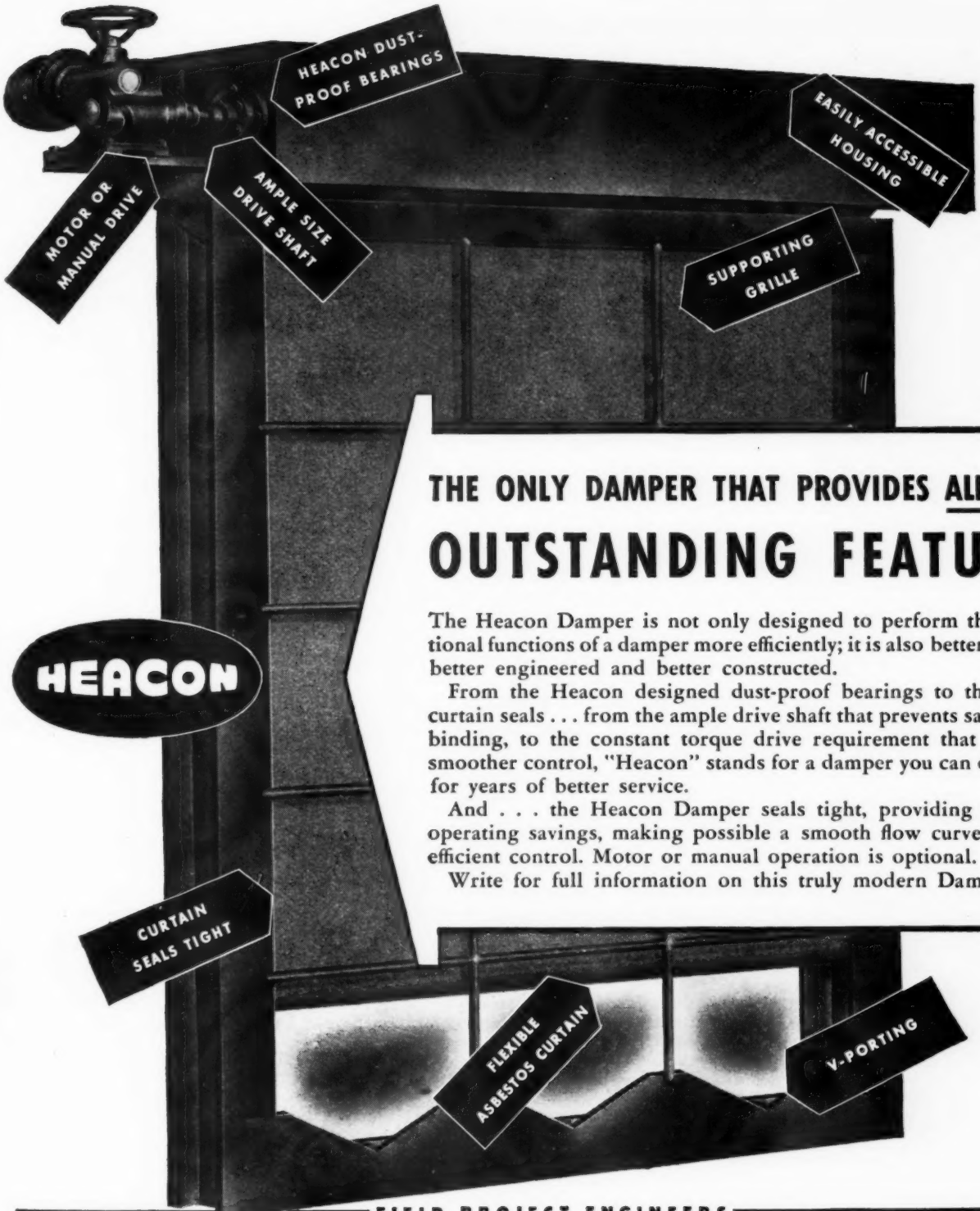
In firetube boilers the strains from feeding cold water are more severe than in watertube units because of the greater temperature difference between boiler metal and water. I recommend that *HW* operate the injector until some other means is provided for heating feedwater. **Arthur Belton, Montreal, Canada.**

Storage-Tank Cost Vs Saving on Coal

PROBABLY *HW* can solve his problem by using a storage tank as shown below. A 1000-gal tank contains about 8330 lb of water. The cylinder would hold 475 lb of steam at 100 psi or a total heat of about 560,000 Btu. This steam would raise the temperature of the water in the heat-storage tank roughly 50 F. Waste flow from heat exchanger may go to hotwell, or if suitable, to hot-water heat-storage tank.

A cylinder full of steam at the pressure mentioned represents only about 100 lb of coal even under the most inefficient operating conditions. The additional saving, even six times in 24 hr, may not compensate for the investment except possibly that the added equipment can be bought second hand. Other features, such as increased boiler output due to hotter feedwater, and





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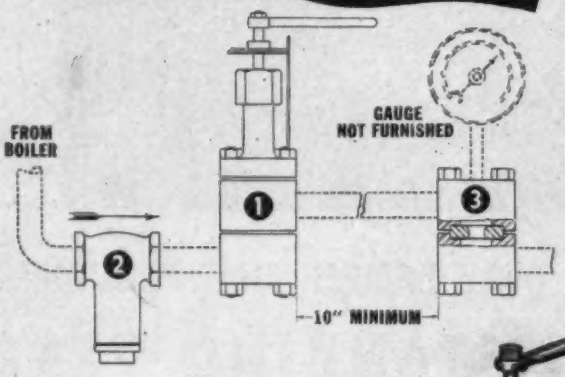

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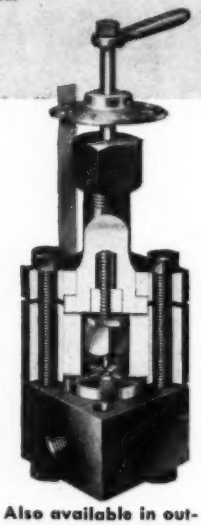

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reduced boiler maintenance due to less water makeup, should be considered in making a final decision. **Henry H Demling, Bronx, N. Y.**

Heat Gain Shown

THE VOLUME of a cylinder, 6 ft in diameter and 65 ft long, is approximately 1837 cu ft. Assuming space occupied by concrete blocks and trucks is 40% of cylinder volume, steam in the cylinder will occupy 60%, or 1100 cu ft. Steam at 100 psi weighs about 0.255 lb per cu ft, hence there are 280 lb of steam to exhaust from each cylinder when the curing, is completed. With two cylinders there are 560 lb available for use each 6 hr.

Heat content of the steam would be approximately 560x970 = 543,200 Btu. If the boiler efficiency is 75%, boiler output per 6-hr period is (9000x9000) ÷ 4 = 20,250,000 Btu. Therefore the heat gain is 543,200 ÷ 20,250,000 = 2.14% if the exhaust steam is used to heat feedwater.

If the exhaust steam is used, a tank having a capacity of 4230 lb or 600 gal is required. This is equivalent to a tank about 4 ft in diameter by 6.5 ft long. Cost of such a tank plus insulation and piping will probably amount to $1000. Whether the investment is worth while is a problem for management. *HW* can adjust the figures in the above calculations since no allowance was made for the heat the blocks would give up in cooling from 308 to 212 F. No consideration was given to the heat loss from the feedwater tank and piping, as it would probably be balanced by the gain from the blocks.

A feedwater-storage tank large enough to use up the available exhaust steam will utilize it effectively, though it may not be worth while from an economy standpoint. **Ira A Butcher, Piney River, Va.**

Believes Open-Type Heater Is Best Bet

IN VIEW OF the short exhaust period, I would not use any elaborate hookup to recover heat from the exhausting steam. I suggest a simple, open-type feedwater heater to have available at all times a supply of hot feedwater for the boiler.

HW could use a pressure-reducing valve to keep steam pressure at 10 psi and an automatic valve to control steam to the hot-water. This valve should be actuated by a thermostat immersed in the heater so the steam will be on only when needed. Set the thermostat for any desired temperature feedwater. *HW*

A Challenge to real Americans

WHY is it necessary to sell America to Americans? One of the reasons is, not until now did the people of this country have to be shown that they lived in the most favored and most favorable country on earth. Where are the salesmen to do this job? Every community has its leaders who have this responsibility, not only to themselves, but to their families, their community and their country

The Youngstown Sheet and Tube Company

General Offices -- Youngstown 1, Ohio
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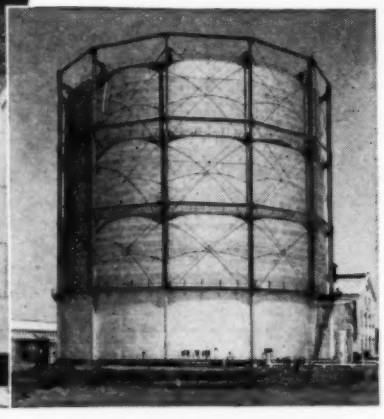
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - TIE PLATES AND SPIKES - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS.

Don't Let Rust and Corrosion Eat Away YOUR PROFITS!

Dum Dum for Metal being applied to the Gas Holder of the Pacific Gas and Electric Company.



The same Gas Holder completely finished with Dum Dum for Metal and protected for many years to come.

Dum Dum for metal gives long-lasting protection to METAL SURFACES

Dum Dum for Metal now offers the same long-term protection to metal surfaces that its famed companion product, Dum Dum for Masonoc, has been giving for years to all types of masonry structures. More than a paint, Dum Dum for Metal is thick, tough, elastic . . . designed specifically to protect metal surfaces against the hazards of weather-wear, industrial fumes and gases. Stops those deadly enemies of metal structures . . . rust and corrosion.

When you cover your vital metal structures with this attractive aluminum colored coating, you give added lustre to your plant, but best of all you cut maintenance costs . . . stop profit leaks. Write today for your copy of this important booklet describing Dum Dum for Metal.

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☐ Please send booklet describing advantages of Dum Dum for Metal.

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ADDRESS _____

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THE ARCO COMPANY
CLEVELAND • LOS ANGELES

can use a trap on the heater return of such characteristics as to be able to lift the condensate back into the tank for feedwater. An overflow and an air vent should be provided. **Arthur J Wenig, Brooklyn, N. Y.**

Accumulator Recommended

IT IS POSSIBLE that *HW* can use an accumulator. If he obtains an old hrt boiler, the exhaust steam that is now wasted to atmosphere can be discharged into it and utilized to raise the temperature of water within. The stored-up energy can be used for heating feedwater after the exhaust period is past.

The principle upon which the accumulator works is that as the pressure rises in a closed steam vessel, less space is occupied by a given weight of steam. At atmospheric pressure, one cubic foot of water changed into steam takes up 1646 cu ft of space, while at 100 psi it occupies 237.6 cu ft. Water in the accumulator takes up the heat from the exhaust steam and builds up a certain amount of pressure in the vessel. During non-exhaust periods, drawing steam from the latter lowers the pressure and causes water to flash into steam, thereby furnishing heat for feedwater. **E R Webber, Duluth, Minn.**

Simple Piping Changes Reduce Steam Waste

HW CAN BEST SOLVE his problem of saving waste exhaust steam by making simple piping changes, and scheduling his processing. His curing cylinders have a net volume (less volume of load) of approximately 780 cu ft. This amounts to 50 lb of steam at 12 psi, but at 100 psi is 250 lb. Therefore if he arranges to exhaust to atmosphere from 12 lb instead of 100, he will immediately effect an 80% saving of present waste. He can accomplish this by ending the final cooking of one cylinder while the 12-lb cooking is going on in another cylinder so that the 100 psi can be bled down to a third cylinder which is starting up.

To make this operation possible an exhaust header with the necessary valves must be so installed that any cylinder can be exhausted to any other cylinder. **J C Porter, Rock Hill, S. C.**

Tips on Designing and Building Feedwater Heater

SINCE FEEDWATER HEATING seems to be a problem with *HW* use of the exhaust process steam appears the most suitable for this purpose. To overcome the

We can't promise this...BUT

We can promise you a MORE PROFITABLE job — if you replace your old boiler with a modern Preferred Unit Steam Generator. You'll have a fully-automatic, completely self-contained unit *built* to make your job easier — *planned* to make management's operations more profitable.

WHY? BECAUSE THE PREFERRED IS THE ONLY UNIT STEAM GENERATOR WITH ALL THESE FEATURES.

1. Induced (Pull-through) Draft, a distinctive feature, eliminating the necessity of building costly stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.

2. Fully Automatic Operation even with Bunker C or No. 6, including the new catalytic residuals.

3. Preferred Oil Burner — built especially for this unit.

4. Four-Pass Gas Travel results in maximum heat absorption.

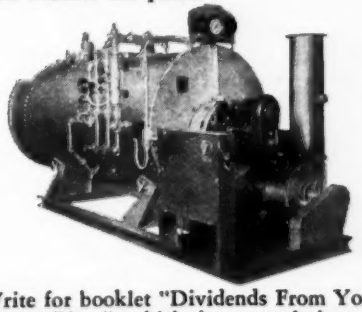
5. 80% Minimum Thermal Efficiency proved and guaranteed.

6. Low Maintenance — the result of over 27 years of combustion engineering experience.

7. Full Range of Sizes — from 20-500 H.P., and pressures of 15 to 200 lbs. Two-pass units in 20 and 30 H.P., 15 lbs. pressure.

Four-pass units also available in all sizes for 250 p.s.i.g. design on special order. Write for complete details of these special units.

These features of the Preferred Unit Steam Generator add up to easier operation for you, more economical power plant operation for management and allow you more time around the plant.



Write for booklet "Dividends From Your Power Plant" which is a revelation on Power Plant Operation and New Bulletin No. 1000E.

P-5-48

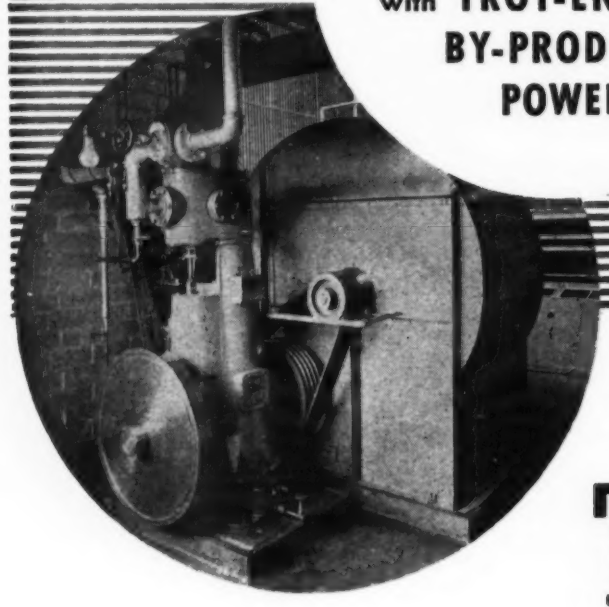
PR-148

PREFERRED UTILITIES MANUFACTURING CORPORATION, 1860 Broadway, New York 23, N. Y.

PREFERRED UTILITIES MFG. CORP.

ARE *You* WASTING BOILER HORSEPOWER ?

GET *Maximum* STEAM EFFICIENCY with TROY-ENGBERG BY-PRODUCT POWER



The modern Troy-Engberg Steam Engine is designed to extract the power from the steam you produce before it passes, with little loss in heating value, into your heating or processing cycles. The steam engine acts as a reducing valve but it's a reducing valve that generates power or drives equipment and then exhausts most of the heat units into your processing or heating lines.

The modern Troy-Engberg Steam Engine also offers the following advantages — wide speed range, high overload capacity, high starting torque, conservative speed, exceptional dependability. Investigate this drive for your stokers, fans, pumps, compressors and generators.

TROY ENGINE & MACHINE COMPANY
(Established 1870)
2500 Railroad Avenue Troy, Pennsylvania

TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

problem of intermittent feeding, *HW* can build or purchase a storage-type feedwater heater of suitable capacity. Selection of an open or a closed heater depends on the state of the steam when it leaves the curing cylinders. If oil or scale-forming substances are present in the steam, a closed heater or a tank with suitable coils is desirable. Steam that is not contaminated can be used in an open heater or permitted to discharge directly into the tank.

Should *HW* decide to design and build the heater or write specifications for it, he should consider the following points. Heater size is dependent upon needed storage capacity and available space in the plant. A proper-size drain, manhole and water gage must be provided. A vent equipped with a safety valve or atmospheric relief valve is also necessary. In either case, ASME rules for the construction of non-fired pressure vessels should be observed.

If construction or purchase of a heater is too expensive, *HW* can build a simple condenser to recover part of the exhaust process steam for future use as feedwater. Immersing a pipe coil in a wooden tank is an easy way to solve this problem. Feedwater may be stored in another wooden tank and used when necessary. **Tyler G Hicks, New York, N. Y.**

Heat Feedwater With Exhaust Steam

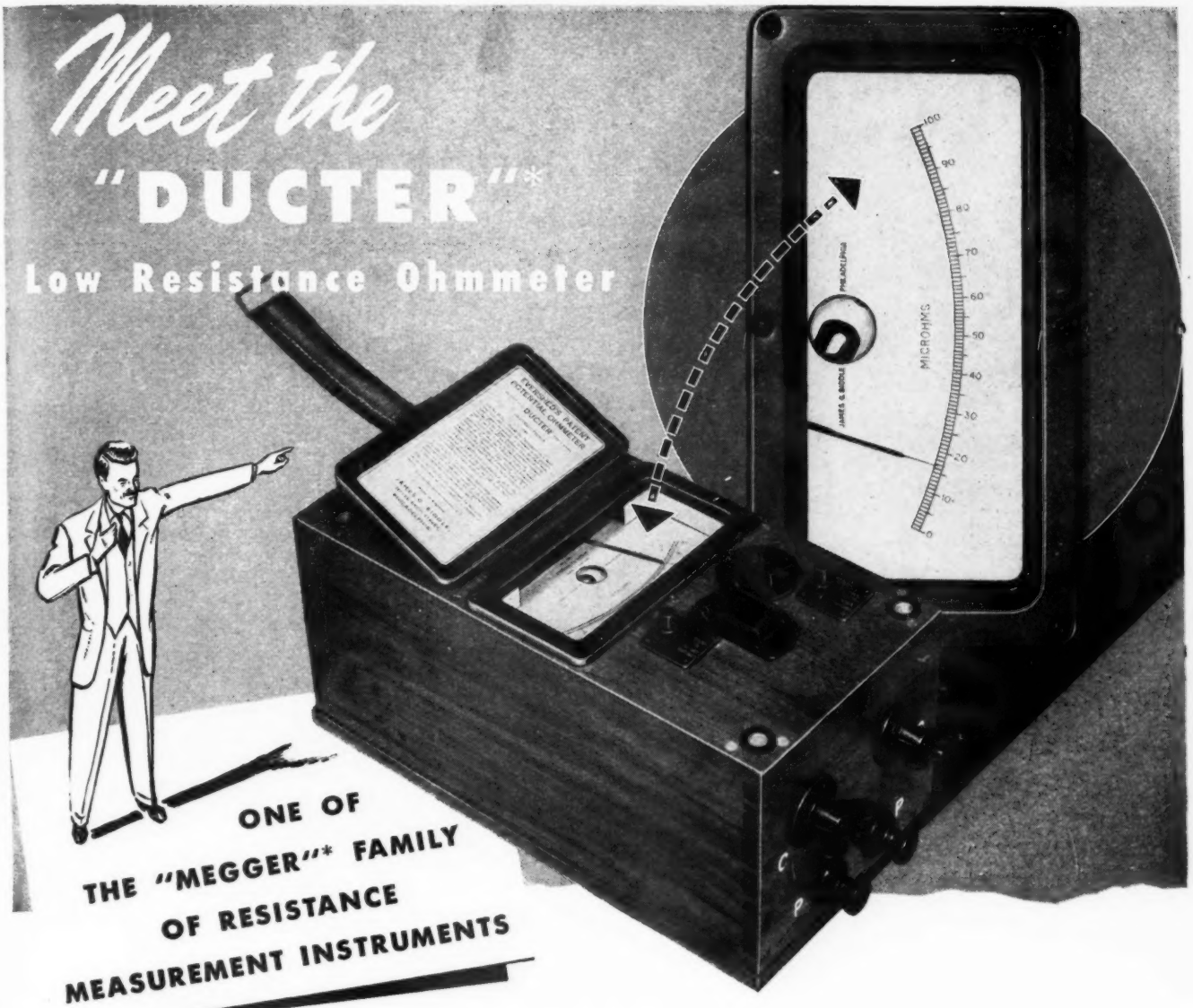
HW USES 4½ TONS OF COAL at 12,000 Btu per lb in 24 hr or (4.5x2000x 12,000) ÷ 24 = 4.5 million Btu per hr. Assuming an efficiency of 72% we get 3.24 millions Btu actually contained in the steam used for curing the concrete blocks.

The steam fed to the cylinders is at 12 psi, or 26.7 psia. We assume the steam is dry, saturated and contains 1161 Btu per lb. Later during the process the steam is raised to 100 lb or 114.7 psia. If the steam is dry and saturated, it contains 1189 Btu per lb. At this pressure and enthalpy (1189), *HW* discharges the steam to heat the countryside.

My suggestion is to install a tank and bypass the feedwater to it. Discharge the steam to the tank and condense it to atmospheric pressure. Every pound of steam will give up 1189 — 180, or 1009 Btu. This will be used in heating the raw feedwater from the Detroit River to 212 F. The tank, in effect, is now a condenser and a heater. Pump this condensate to the boiler to raise the temperature 338-212, which is 126 F. **J Yavitch, Philadelphia, Pa.**

Meet the "DUCTER"*

Low Resistance Ohmmeter



ONE OF
THE "MEGGER"* FAMILY
OF RESISTANCE
MEASUREMENT INSTRUMENTS

Rugged, accurate and direct-reading, the "Ducter" Low Resistance Ohmmeter provides an easy and practical way to test air and oil circuit breaker connections and contacts; cable joints; bus bar and line connections; armatures and series fields of generators, and motors; and low resistance transformer windings. It is also a valuable tool in quality control and for indicating relative strength and conductivity of welded joints.

One man can quickly make resistance measurements down to a millionth of an ohm—in the field! There are no calibrations or adjustments—not even for the voltage of the battery that supplies the necessary test current—and there are no calculations or charts. The resistance measurement is read directly from the position of the pointer on a scale.

The "Ducter" operates from an external battery or plug-in power supply. On every range it is compensated for outside temperature changes. As a protective feature a cut-out is included in the circuit to prevent application of too high voltage, and very high resistances or open circuits.

Various ranges of "Ducter" Ohmmeters are available to suit your requirements. A complete description, together with circuit diagrams, applications, and specifications are contained in Bulletin 24-25-P. Write for your copy TODAY and learn all about this truly remarkable instrument.

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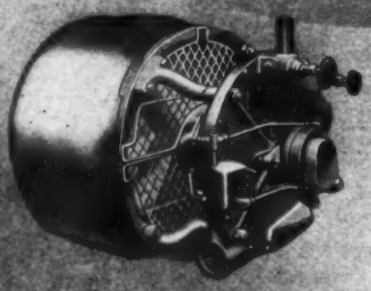
Wing

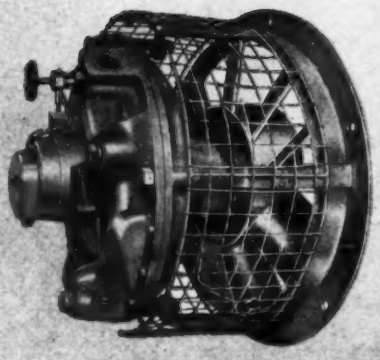


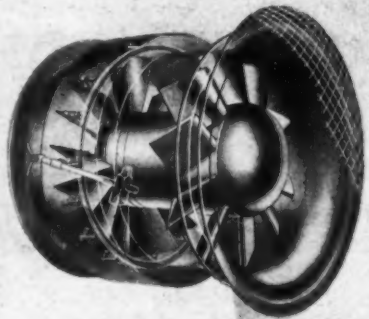
WING TURBINE DRIVEN BLOWERS
Type K
For Brickwall Mounting

Wing pioneered in forced-draft turbine blowers over a third of a century ago. Today Wing Turbine Blowers are in use in thousands of installations in many varied industries. They are simple and rugged in construction, quiet and dependable in operation. Oil-free exhaust can be used for heating, process or feed water.

WING TURBINE DRIVEN BLOWERS
Type R
For Horizontal or Vertical Mounting on Wind Boxes or Air Ducts

Ideal where use can be made of exhaust steam or where electricity is not available. Flexible capacity regulation by throttling steam to turbine—manually by hand valve or automatically by combustion control. Prompt shipments (no waiting for motors).





WING MOTOR DRIVEN BLOWERS
TYPE COM (TWO STAGE)
TYPE EMD (SINGLE STAGE)

Wing Motor Driven Blowers are axial flow forced draft blowers of simple, rugged construction, compact design and highest efficiency. Type EMD has capacities up to 50,000 CFM with statics to 5". Type COM can handle statics up to 30" on special designs.

Write for Bulletin SW-1

L. J. Wing Mfg. Co.
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TURBINE BLOWERS • TURBINES • FANS • MOTOR DRIVEN BLOWERS
REVOLVING UNIT HEATERS • UTILITY HEATERS • FIXED DISCHARGE UNIT HEATERS
DUCT FANS • DRAFT INDUCERS • HEATER SECTIONS • SHIP VENTILATORS • FOG ELIMINATORS

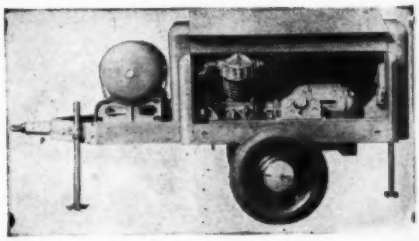
New Equipment

(*Continued from page* 136)

Water Softener E168

IMPROVED ZEOLITE WATER SOFTENER is designed to accommodate as much as 44% more zeolite with no increase in over-all equipment size; thus it delivers as much as 44% more soft water. Its distributing and collecting manifold arrangement guards against zeolite loss and makes it possible to utilize the zeolite bed most efficiently, says the manufacturer.

Added soft water output is significant as far too often there is not enough soft water for all uses. Existing zeolite water softeners can be fitted to operate on the same principle, making possible a comparable increase in soft-water output. **Elgin Softener Corp, 141 N Grove Ave, Elgin, Ill.**



Air Compressors E169

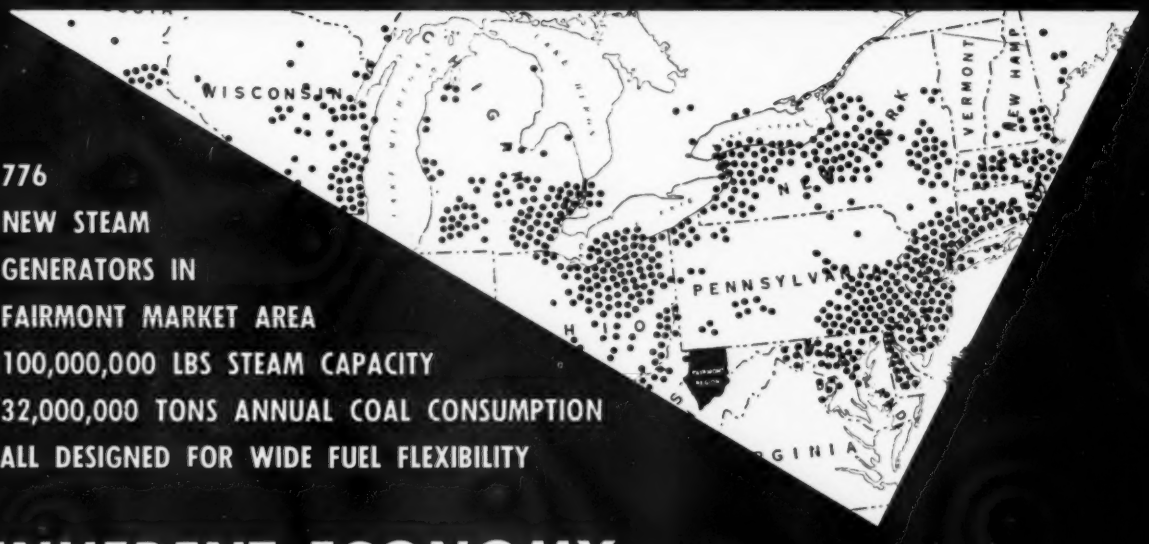
PORTABLE ELECTRICALLY-DRIVEN air compressors, in sizes from 60 to 315 cfm, are available in skid, 2-wheel trailer and 4-wheel trailer mountings. Known as *Air Chief Electrics*, the compressors are of 2-stage construction, equipped with intercooler and safety valves. Direct driven from 1200 rpm, 220-440-v ac squirrel-cage motors. **Davey Compressor Co, Kent, Ohio.**

Temperature Indicator E170

ACCURACY in reading under the worst conditions is assured by the visual contrast of this new transformer temperature indicator. The scale is uniform over its entire range. An oil-type mounting bulb permits removal and installation of the unit without changing oil level or disconnecting transformer.

A red maximum temperature indicating

THE EXPANDING MARKET FOR FAIRMONT COAL



776
NEW STEAM
GENERATORS IN
FAIRMONT MARKET AREA
100,000,000 LBS STEAM CAPACITY
32,000,000 TONS ANNUAL COAL CONSUMPTION
ALL DESIGNED FOR WIDE FUEL FLEXIBILITY

INHERENT ECONOMY...

Inherent economy is the underlying reason for Fairmont's fast becoming the most favored coal field serving the great industrial triangle whose base lies on the Eastern seaboard between Maine and Virginia and whose apex is in Minnesota. In this vast area is found the greatest industrial concentration in the world. Coincidentally, it is also the greatest coal consuming area.

Strategically located in Northern West Virginia, the Fairmont Field, with its large reserves and excellent rail, river, lake and tidewater transportation facilities, is well appointed to serve industry.

Until recent years, many consumers were unable to take advantage of the economy offered by Fairmont low-ash-fusion coals, because of inadequate fuel-burning equipment. However, today consumers are buying equipment incorporating the latest technological advances in design which assures high thermal efficiency and excellent performance with coals of widely different characteristics.

To meet the unprecedented demand for its economical fuel, the Fairmont Field is engaged in a long-range development program and production capacity is being expanded as rapidly as mining and transportation equipment becomes available.

The Fairmont Coal Bureau is rendering SERVICE TO INDUSTRY through engineering bulletins, fuel studies and cooperation with equipment manufacturers and consulting engineers.

Literature is available describing the technique of "Conservative Design" for steam generators employing various methods of firing.

FAIRMONT COAL BUREAU, Chanin Bldg., 122 E. 42nd St., New York 17, N. Y.

Please send me the Bibliography of technical publications available for distribution by the Bureau ☐. Also include my name on mailing list for future releases ☐.

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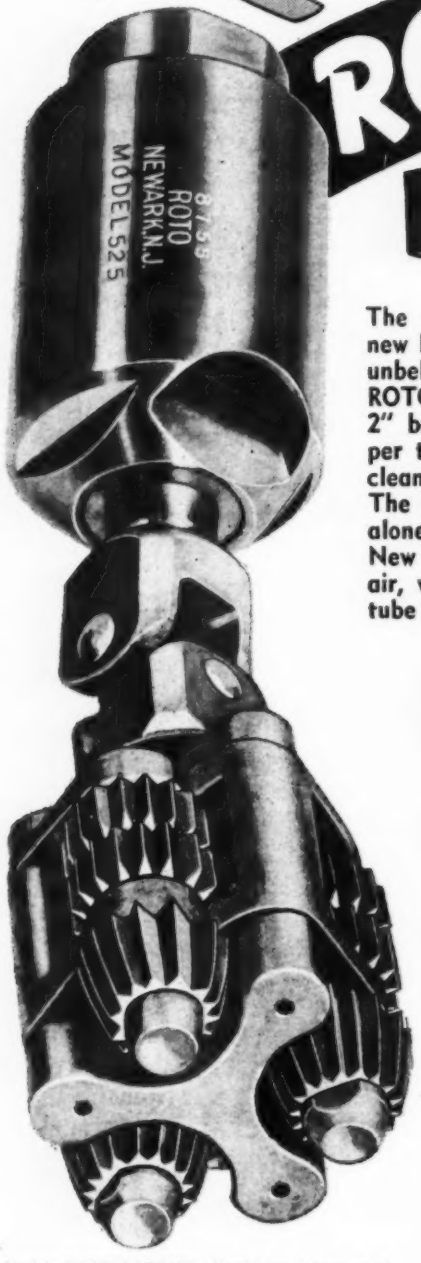
P-5-48

Unequalled Speed

IN THE AIR

ROTOJET

for tube cleaning



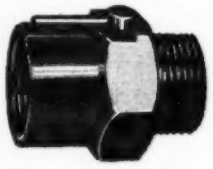
Model C-525 ROTOJET Air-driven Motor with swing frame head and universal joint for 2¾" - 3½" I.D. curved tubes.

The tremendous power developed by the new ROTOJET enables it to clean tubes at unbelievable speed. On one recent job, a ROTOJET Model 505 cleaned badly scaled 2" boiler tubes at the rate of 5 minutes per tube in one pass, while ordinary tube cleaners required two passes and 20 minutes. The time and labor saved on this one job alone, more than paid for the ROTOJET. New ROTOJET models for operation with air, water or steam are stocked for most tube sizes. Send for new bulletin.

ROTOJET

Air-driven

TUBE CLEANERS



Roto Air Valve for curved tube cleaners.

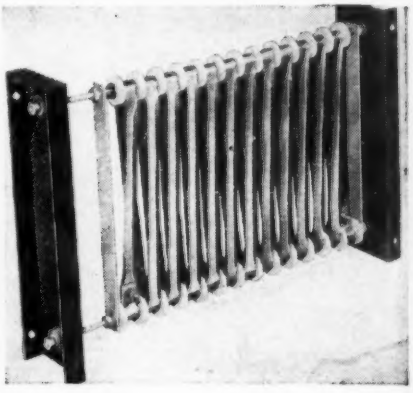
Roto Air Valve Saves Labor

By installing an inexpensive Roto Air Valve directly behind the motor, tube cleaning becomes a one-man job, eliminating a helper and speeding up the cleaning. Made for all straight and curved air-driven tube cleaners.

ELLIOTT COMPANY-ROTO DIVISION

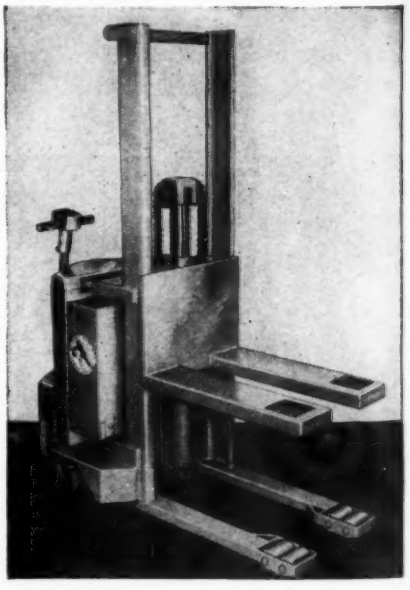
153 Sussex Avenue Newark 1, N. J.

hand is reset by wiping a small magnet over face of cover glass, which has a weatherproof construction to prevent fogging. This magnet is secured at all times on a light chain to prevent loss. The instrument can be furnished with an alarm contact for indication whenever a predetermined temperature is reached. **Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa.**



Resistors E171

A NEWLY DESIGNED series of resistors intended for continuous high-current applications, the *Loopohm* resistors are suitable for use where mechanical shock and vibration prevail. Standard *Loopohm* resistors are available with a continuous current rating from 20 to 110 amp. They can be furnished with tapered current capacity, fixed or adjustable clamp taps, end frames and sheet or expanded metal enclosures. **Ward-Leonard Electric Co, Mt. Vernon, N. Y.**



Material Stacker E172

JACKSTACKER is designed for both movement and stacking of materials on skid platforms, pallets or in sectional bins, particularly where aisles are narrow, areas congested, or where floor or elevator capacities prohibit using fork trucks or heavy equipment. It is available in capacities up

*It Cost $100,000 to Save $29.93**

A Black, Sivalls & Bryson SAFETY HEAD costing $29.93 would have prevented this explosion causing property damage of $100,000.

The BS&B SAFETY HEAD is a rupture disc of corrosion-resisting metal mounted between two flanges and that bursts in tension at predetermined pressure. A burst disc is quickly replaced to return the SAFETY HEAD to service. SAFETY HEADS are available in many types and sizes, each designed for the particular requirements of the individual installation or job. Don't take any chances. Put SAFETY HEADS to work in your plant today protecting life and property.

Write for complete details. Address Industrial Power Department, Special Products Division, Black, Sivalls & Bryson, Inc., Power and Light Building, Kansas City 6, Missouri.

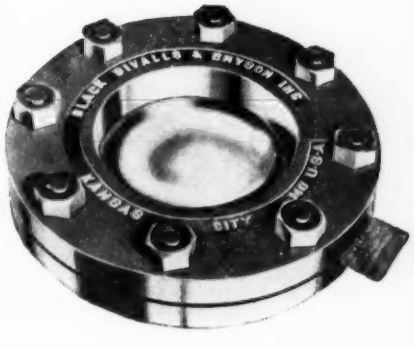


*Illustration is an artist's conception of an actual explosion which resulted in property damage of $100,000.

EFFICIENCY

FOREIGN INQUIRIES INVITED Cable Address: BLACK, KANSAS CITY, U.S.A.

BLACK, SIVALLS & BRYSON, INC.

RELIABILITY

KANSAS CITY, MO. OKLAHOMA CITY, OKLA.

YOU CAN HAVE A

Better PRODUCING BOILER

AT LESS COST TO OPERATE . . . .

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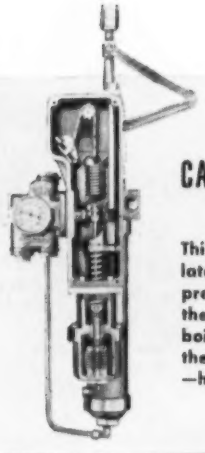
CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS



CASH STANDARD FUEL FEED CONTROLLER . . .

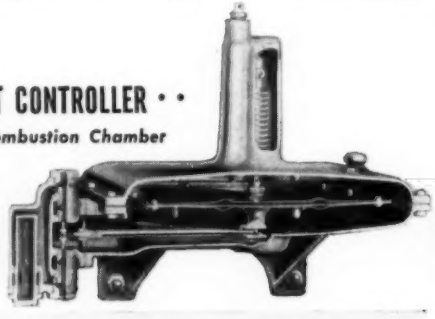
Automatically Regulates Fuel Feed

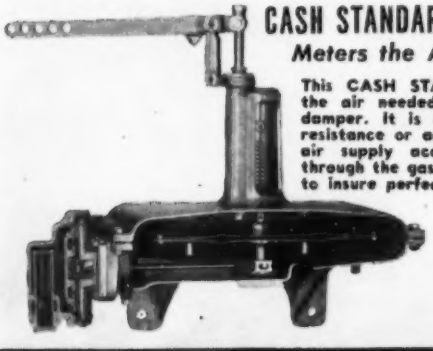
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion —hence, money saving.

CASH STANDARD FURNACE DRAFT CONTROLLER . .

Maintains a Constant Draft in the Combustion Chamber

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.





CASH STANDARD AIR FLOW CONTROLLER . . .

Meters the Air Needed for Combustion

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

Write today for Bulletin No. 300.

2. GET

AUTOMATIC REGULATION OF FUEL FEED

METERED AIR NEEDED FOR COMBUSTION

A CONSTANT DRAFT MAINTAINED IN THE COMBUSTION CHAMBER

3. REALIZE

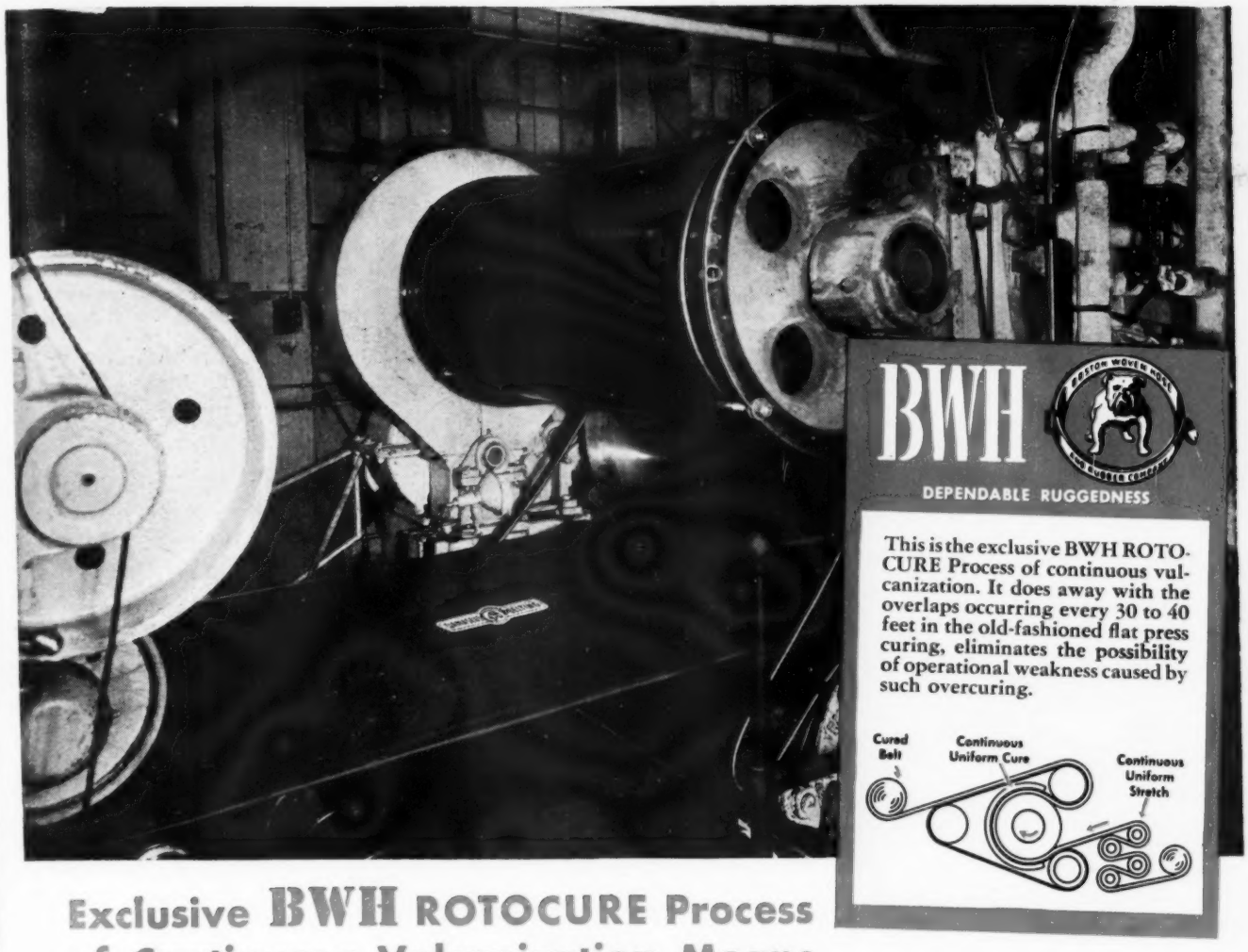
MORE STEAM FROM YOUR PRESENT BOILER

LESS FUEL - COAL - OIL - GAS
LESS COSTS
SAVINGS IN MAINTENANCE . .

whether you have a single boiler or battery of boilers

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES


BWH
DEPENDABLE RUGGEDNESS
This is the exclusive BWH ROTO-CURE Process of continuous vulcanization. It does away with the overlaps occurring every 30 to 40 feet in the old-fashioned flat press curing, eliminates the possibility of operational weakness caused by such overcuring.
Cured Belt
Continuous Uniform Cure
Continuous Uniform Stretch

Exclusive BWH ROTOCURE Process of Continuous Vulcanization Means

NO "SPECULATION" ON THIS WHEAT BELT!

The operator of a big grain elevator required leg belts that would elevate wheat at the rate of 50,000 bushels per hour.

A BWH distributor surveyed the problem. He recommended a BWH Damascus Belt, 74 inches wide—11 ply, made by the famous ROTOCURE process of continuous vulcanization. A 367 foot belt was installed, with 1,468 buckets attached. The belt was run at a speed of approximately 864 F.P.M. with a 60" head pulley and a 36" boot pulley. Scale tests proved that this belt not only lived up to service specifications but exceeded them. So it's no wonder a duplicate BWH Belt was specified as a replacement!

Here's why belts made by the ROTOCURE Process are constantly making just such outstanding performance records:

1. ROTOCURE eliminates the press overlaps which occur every 30 to 40 feet in belts made in a flat press. And actual tests prove such overlaps may reduce flex-life as much as 40%.
2. ROTOCURE eliminates mechanical distortion, which occurs at press ends in flat-press curing.
3. ROTOCURE eliminates uneven stretch, because this process maintains constant, uniform stretch control during curing.
4. ROTOCURE eliminates overcure caused by press overlaps in rubber covers of conveyor belts, makes them uniformly abrasion-resistant.

* * *

HAVE YOU A JOB WHERE STAMINA COUNTS?

Bring us your toughest problems — we're specialists in solving them. Consult your nearest BWH distributor or write us direct.

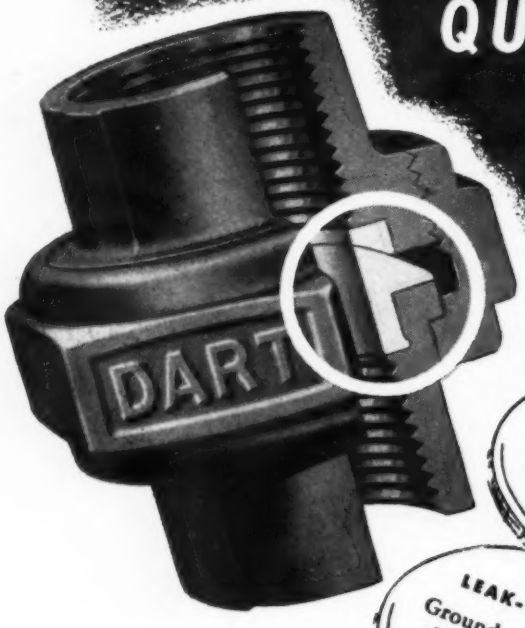
Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all principal cities

PLANT: CAMBRIDGE, MASS., U. S. A. • P. O. BOX 1071, BOSTON 3, MASS.

EACH
DART UNION
HAS THESE
MONEY-SAVING QUALITIES



2 NON-CORRODING BRONZE SEATS
Dart economy begins with the two precision-ground seats which, being made of bronze, are non-corroding.

LEAK-PROOF BALL JOINT
Ground to a *true ball joint*, the seats close easily to a drop-tight, leak-proof connection, and open just as easily for repeated use.

HEAVY PROTECTIVE SHOULDERS
These extra-heavy shoulders enable Darts to withstand strains and abuse.

EXTRA-STRONG BODY
High-test, air-refined malleable iron body and nut are practically indestructible.

Always Specify DARTS — because in length of service they cost least.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART UNIONS

to 4000 lb in four models. The electro-hydraulic lifting and lowering and gear-drive traction unit are battery powered through series-wound electric motors.

All controls, two speeds forward and reverse, raising and lowering, horn button and key switch, are mounted in the steering-handle head. Therefore lifting carriage can be raised or lowered when truck is in motion without moving away from the handle. Master drive unit, including traction mechanism, is mounted on articulated linkage to insure adequate traction when going over sills, ramps or uneven floors. Safety brake applies automatically when handle triggers are not held down. Drive unit assembly can be changed in 20 min. **Lewis-Shepard Products, 285 Walnut St, Watertown 72, Mass.**

Cutting Torch E173

CUTTING TORCH STYLE 9016 is available in 21- or 36-in. lengths, equipped with a 90-deg torch head. Cuts stainless steel using Airco's Flux-Injection process. Constructed with monel metal head, stainless-steel tubes, and stainless-steel lever and ribbed handle. Remote control cutoff automatically coordinates flux feed with cutting oxygen to eliminate separate flux control. **Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.**

Automatic Air Vents E174

MAID-O'-MIST automatic air vents are for hot- or cold-water lines, hot-water radiators, convectors, unit heaters and other applications where air pockets retard free circulation. Working parts are mounted on a removable bonnet for quick servicing. Valve has monel metal spring and Neoprene valve seat. No. 7 is for pressures not exceeding 75 psi. No. 77 is same as No. 7 with additional pipe connection on side, and No. 27 is for pressures not exceeding 50 psi. **Maid-O'-Mist, Inc, 3217 N Pulaski Rd, Chicago, Ill.**

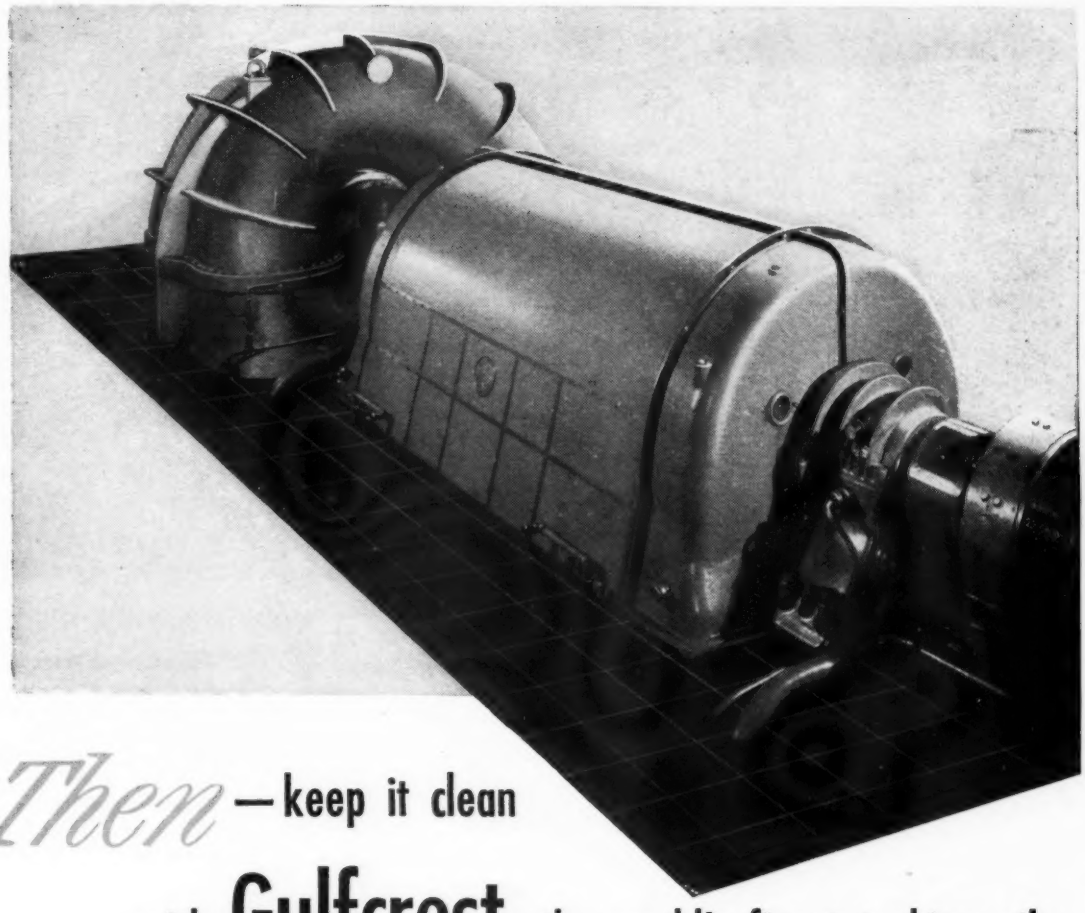
Top-Suction Pump E175

DESIGNED TO PREVENT water-pressure from breaking shaft oil seal, this air-operated sump pump has top suction. When pump is not in operation, oil seal is subjected to static pressure only from depth of submersion in sump. Pump is operated by vane-type air motor. When pump operates

First — make sure the lubricating system is clean

with Gulf Turbine Flushing Oil

— *cleans effectively*
— *protects against rust*
— *does not affect lubricating qualities of turbine oil*



Then — keep it clean

with Gulfcrest, the world's finest turbine oil

BY taking these two steps, you can insure top lubricating efficiency down through the years for your new steam turbine.

The use of Gulf Turbine Flushing Oil—before the initial fill of lubricating oil — will remove grease type slushing compounds and carry away harmful abrasives which might be in the circulating system. Thus you make sure the system is clean—and avoid the possibility of trouble caused by contaminants.

For the finest lubrication — longer-lasting protection — it will pay you to investigate the advantages of Gulfcrest Oil WCR. Because of its outstanding resistance to oxidation—it's Alchlor-processed — Gulfcrest Oil WCR lasts indefinitely. With this quality oil and good operating practice, you can be sure there will be no sludge deposits in cooler tubes, bearing pedestals, or oil lines to worry about.

To get these benefits for your new turbines, call in a Gulf Lubrication Engineer today. Write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

GULF INDUSTRIAL LUBRICATION

• Valve and float mechanism mounted on cover for quick, easy cleaning. Stainless steel valve and seat reversible for double life. Inlet and outlet connections arranged for convenient piping. Complete line for wide range of capacities. For all steam pressures to 125 psi. Available in float only type or float and thermostatic type.

Write for Folder 247

AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N. Y.
SINCE 1877

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Atlanta Lamar 3871
ILLINOIS
Chicago Andover 7050
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INDIANA
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Honolulu 6401
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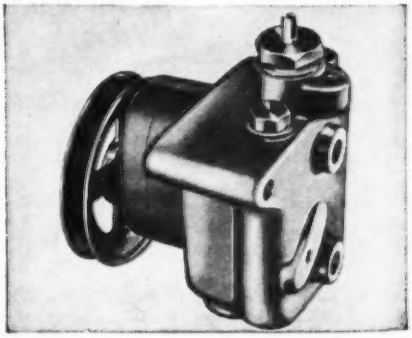
San Juan 2-8475
ARGENTINA
Buenos Aires Belgrano 964

water cannot reach oil seal on air motor.

Closed impeller is made of hard abrasion-resistant alloy. A built-in oiler lubricates all pump's moving parts. Oil chamber has one quart capacity for 24-hr normal operation. Pump is lightweight and has substantial welded-on handles that assure easy lifting and moving from place to place. **Gardner-Denver Co, Quincy, Ill.**

Masonry Drill Kit E176

METRO CARBIDE MASONRY DRILLS are available in a handy kit of six of the most commonly used sizes, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{5}{8}$ in. covering a wide range of applications. Sturdy leatherette case, durably constructed, protects the drills. Comes complete with operating instructions. **Metro Tool & Gage Co, 4240 Peterson Ave, Chicago 30, Ill.**



Midget Hydraulic Unit E177

HYDRAULIC POWER UNIT serves many purposes for industrial operations, plant maintenance and service repairs, as arbor press, hydraulic clamping vise, straightening and bending device. It consists of a hydropower gear pump with hardened and ground gears running in bronze bearings; a compact housing to protect check valves;

AVOID THE LUXURY TAX

on Idle Horsepower

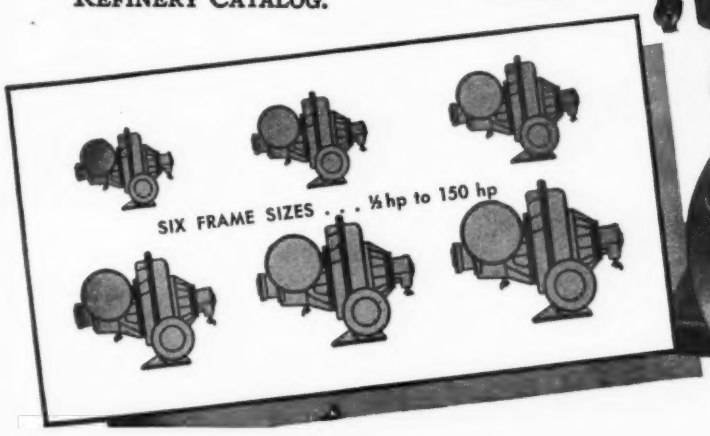
When your horsepower needs are small, why pay the extra cost of larger turbines, designed for much more power than you require?

You pay only for the horsepower you need when you fit the right Coppus "Blue Ribbon" Turbine to the load. They're made in six frame sizes . . . from 150 hp down to fractional . . . priced in proportion to their size.

That's why you'll see more and more Coppus turbines powering pumps, blowers, fans, stokers and other equipment requiring a steady source of small hp. *Steady* is the word for these busy little turbines. Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.) each Coppus turbine is precision-made, with close tolerances checked by Johansson size blocks. And before shipment, the turbine you get is dynamometer-tested.

No wonder more than 85% of all orders for Coppus turbines since 1937 have been repeats . . . and that a growing number of nationally known manufacturers are installing "Blue Ribbons" on their original equipment.

Write for Bulletin 135–10. COPPUS ENGINEERING CORPORATION, 165 Park Avenue, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG and REFINERY CATALOG.



JEFFERSON
SPECIALTY UNIONS

Jefferson Union Tee, Male-Female with union on the outlet.

RECESSED BRASS SEAT

An exclusive, patented feature of all Jefferson Unions is the brass seat. This seat which provides a true ball joint, is so located as to be fully protected from screwed in pipe ends and at the same time permits free flow through the joint. The brass ring is so forced into its recess that it becomes, in effect, one-piece with the iron of the fitting.

SAVE 3 JOINTS . . *with this* JEFFERSON *Specialty* UNION

This Jefferson Union Tee, with union on the outlet, takes the place of an all-female union, two nipples and an ordinary tee. In other words by using this 'Jefferson', you can actually save three joints. In addition, you save time, space and money. Furthermore you can be assured of a much better piping job.

It will be to your advantage to get full details on the complete line of Jefferson Unions from your nearest distributor . . . or from us direct.

JEFFERSON UNION CO.

601 West 26th St. New York 1, N. Y.
LEXINGTON 73, MASS. LOCKPORT, N. Y.

One Man at One Point

. . . Controls All!

With Beaumont Birch Coal Handling Equipment, one operator controls *all* coal handling with finger-tip controls, like this—

Coal arrives by rail, is dumped into hopper, raised by bucket elevator and discharged either into bunker for immediate use or down a chute to yard storage. If it goes to storage, the Beaumont Drag Scraper spreads it into safe, compact layers—eliminating air pockets.

Use any available space. Tail-blocks can be slung between posts and moved by hand—and mechanically moved on I-beam track, by tail-block car, or suspended from an aerial bridle system. The scraper and cable system is operated by *one* man through remote control. *One* company, Beaumont Birch, supplies all necessary equipment.

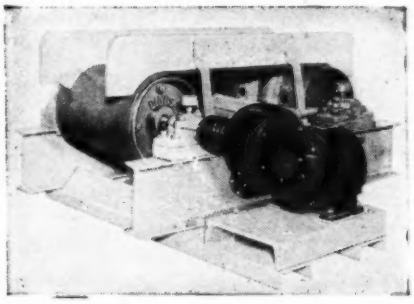
Complete engineering service available by writing right now to—

BEAUMONT BIRCH COMPANY
1502 RACE STREET • PHILADELPHIA, PA.

Designers Manufacturers Erectors BULK MATERIAL HANDLING SYSTEM

and a 4-way control valve for operation of double-acting cylinder, hydraulically actuated in either direction.

Unit measures 6x7x9 in. and has 3-gpm oil capacity at 1200 rpm, or 4½ gpm at 1800 rpm and 1000 psi. It requires about 2½ hp to operate at 1200 rpm. Equipped with V-belt sheave for driving from fan shaft or power takeoff. Clutch cuts out unit when not in use. **Hydraulic Press Mfg Co, Springfield, O.**



Magnet-Pulley Separators E178

SELF-CONTAINED horizontal and inclined magnetic pulley separators have an alnico magnetic pulley, idler pulley, endless belt and drive. These units automatically remove tramp iron from coal, plastics, ore, grain, etc, where either protection of machinery or purification of product is desired. They are installed at the discharge of chutes, hoppers and conveyor belts or they can be fed by hand or by materials-handling devices.

Standard models have belts of any desired length in widths ranging from 12 to 60 in. and pulley diameters from 12 to 30 in. standard. **Dings Magnetic Separator Co, 4740 W McGeogh Ave, Milwaukee 14, Wis.**

Paint-Spray Gun E179

MICRO-SPRAY PAINT-SPRAY GUN gives fine atomization to produce a smooth high gloss finish. Simplicity of design cuts cleaning time. Entire head can be quickly removed as a unit by merely removing locking screw and locknut. Only one fluid needle is re-

WHATEVER YOUR PIPING NEEDS ★

SHAW

fills them quickly • dependably

dependable

PIPING

pre-fabrication • installation

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping—any place in the United States and Canada.

Lewis A. Shaw III

President

KNOWN SINCE 1893 FOR HIGH QUALITY

BENJAMIN F. SHAW COMPANY • 2ND & LOMBARD STS. • WILMINGTON, DELAWARE

The company your boiler keeps

APEXIORIZED

New boilers APEXIORized during the past year alone are serving these industries:

CHEMICALS	MACHINERY
FOODS	PUBLISHING
PETROLEUM	UTILITIES
BREWERIES	GOVERNMENT
TEXTILES	INSTITUTIONS
PAPER	MINING

Pick any industry where steam is generated for power or process and you've named a representative group of APEXIOR users — engineers who have proved the worth, in boilers large and small, of internal protective surfacing.

They know that even the strongest steel is powerless to resist moisture penetration — that water at its finest retains the capacity to impair — can never improve — bare steel. And so they separate the two, sealing boiler metal beneath a tissue-thin barrier of APEXIOR NUMBER 1.

Meeting steam and water is a surface that neither can dissolve — smooth, to deny a foothold to deposits — inert, so that it forms only a readily broken mechanical bond with any that adhere. The result, for the legion of APEXIOR users — —

- *maximum boiler availability — security against corrosion*
- *improved circulation, through friction-free tubes*
- *constant high heat-transfer efficiency*
- *easier, less frequent cleaning — lower maintenance cost*
- *speedier, positive inspection*
- *less outage time — longer on-the-line service*

Write us for more facts about:

DAMPNEY maintenance for metal

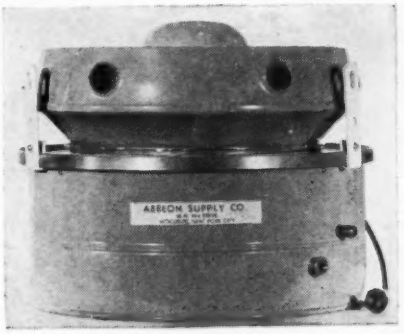
THE DAMPNEY COMPANY of AMERICA • Hyde Park, Boston 36, Mass.

quired for all paint spraying. Spring-loaded, self-adjusting packing at fluid-needle and air-valve stems eliminate leakage and need for adjustment. Fluid needle assembly can be removed in one piece in a few seconds. A built-in lever gives quick, fingertip control of desired air volume, according to setting marked on gun body. **Kellogg Div, American Brake Shoe Co, 97 Humboldt St, Rochester 9, N. Y.**

Distribution Capacitor E180

NEW DESIGN permits the 25-kvar capacitors to increase their capacity 66⅔% over present 15-kvar unit, with an increase in weight and volume of only 50%. Size of new unit is equivalent to that of existing 15-kvar unit.

Inerteen provides the dielectric, while porcelain terminals are solder sealed for tight weatherproof bushing joints. Steel case is welded and has a weatherproof zinc spray finish. Capacitors are available for all the usual distribution voltages from 2400-v delta or 4160-v Y to 7960-v delta or 13,800-v Y. **Westinghouse Electric Corp, P O Box 868, Philadelphia 30, Pa.**



Industrial Humidifier E181

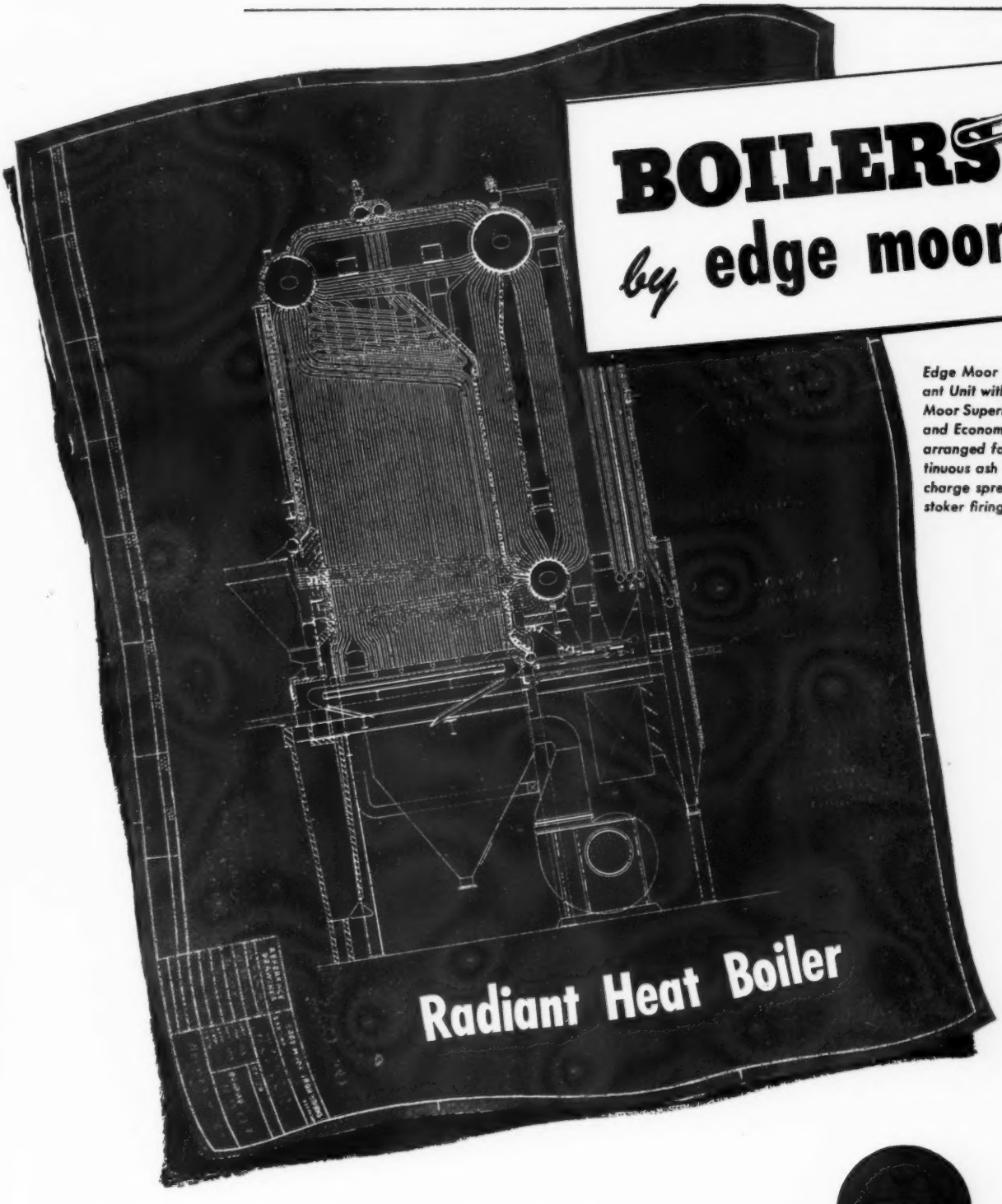
MOISTURE ATOMIZATION without pumps, compressors or steam is the claim of this manufacturer for his self-contained humidifier. A water-supply line feeds a completely covered pan in lower portion of unit. No return line is needed. Air comes in through the bottom through a fiber-glass filter. Automatic controls are supplied for regulation of humidity.

Ball-bearing motor for directional dome draws less than 100 watt, it is said. Vaporization capacity is over one gallon per hr, and domes come in single, double, or 360 degree directional outlets. **Abbeon Supply Co, 58-10 41st Drive, Woodside, New York, N. Y.**

Paint Scraper E182

RED-DEVIL PAINT SCRAPER has a blade made of cemented carbide. Blade is held in the rustproof scraper handle with a set-screw. Four working edges of the blade, plus four individually shaped corners that fit into practically any corner or molding, give the scraper a wide range of uses. Blade can be sharpened on any fine-grained silicon-carbide wheel or stone. **Red Devil Tools, Irvington, N. J.**

BOILERS *by* edge moor



Edge Moor Radiant Unit with Edge Moor Superheater and Economizer arranged for continuous ash discharge spreader stoker firing.

Here is a unit designed to give the advantages of a 3-drum boiler, maximum boiler tube surface exposed to radiant heat and a water-cooled furnace—all in a minimum of space. Advantages include large water storage, generous steam liberation surface and quiet offtake drum. This quick-steaming unit delivers continuous high ratings over many years and is adaptable to all fuels.

This and other types of Edge Moor boilers are available in a wide range of capacities, pressures and accessory equipment. Write for literature today. EDGE MOOR IRON WORKS, INC. Main Office and Works: Edge Moor, Delaware. Branch Offices and Agents: Atlanta, Boston, Chicago, Detroit, Hoboken, St. Paul, San Antonio and San Francisco.

EM

edge moor

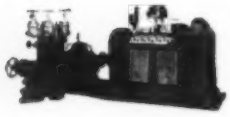
steam generating equipment

PEERLESS
HORIZONTAL CENTRIFUGAL
PUMPS

TYPE A
Single Stage Pump

FOR CONTINUOUS DUTY GENERAL SERVICE PUMPING PEERLESS TYPE A PUMPS

Capacities: Up to 70,000 G. P. M.
Heads: Up to 300 feet
1 to 1000 H. P. • All Types Drive



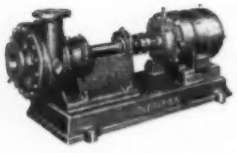
TYPE AF
With Complete Fittings

FOR ADEQUATE FIRE PROTECTION SERVICE TYPE AF FIRE PUMPS*

Underwriters' Approved

Capacities: 500 to 2000 G. P. M.
Pressure: Up to 150 lbs.
20 to 250 H. P.

**Formerly Dayton-Dowd*



TYPE C
Single Stage Pump

FOR ACIDS, CAUSTICS, HOT OILS, CHEMICALS & PROCESS SERVICES... PEERLESS TYPE C PUMPS

Capacities: 10 to 1200 G. P. M.
Heads up to 100 lbs. • 1 to 60 H. P.

FOR MOST SERVICES IN ALL INDUSTRIES

fmc PEERLESS PUMPS

Request Bulletins On The Type Required For Your Applications.

PEERLESS PUMP DIVISION
Food Machinery Corporation

Factories: Los Angeles 31, Calif.; Quincy, Ill.; Indianapolis, Ind. District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 No. Broadway; Atlanta Office: Rutland Bldg., Decatur, Ga.; Dallas 1, Texas; Fresno, Calif.; Los Angeles 31, Calif.

Power News

(*Continued from page* 132)

ference, where the subject of diesel fuel oils was presented, the division is arranging a special series of lectures on lubrication. This series, at New Jefferson Hotel on May 19, will be presented at three 2-hr lectures by two nationally recognized experts. Mayo D Hersey, research associate, Massachusetts Institute of Technology, will discuss *Basic Principles of Lubrication* and *Engineering Applications of Lubrication*, and Dr James B Rather Jr, technical service dept, Socony-Vacuum Laboratories, will report on *Manufacture, Classification and Test Significance of Lubricating Oils.*

Registration for the series, which will be restricted to about 100 engineers, should be made by mail to Special Lectures Chairman John C Gibb, Room 1348, 26 Broadway, New York 4, N. Y. Fee for the complete series, payable in advance on application, is $12 to ASME members and $15 to non-members.

Joint Synthetic-Fuel Research Program

In the course of raising the "curtain" on more than a decade of synthetic gasoline research, it was made known recently that a merger of the synthetic-fuel program of Cities Service with that of M W Kellogg Co, petroleum engineers, has been quietly in effect since 1946 and that Kellogg is now prepared to license synthetic-fuel plants on behalf of both companies. The announcement came in a statement jointly issued by W Alton Jones, president of Cities Service Co and M W Kellogg, chairman of board of the engineering firm.

"The combination of programs was a natural result of the complementary activities of both companies over a long period of time," the statement said. "Cities Service has long been interested in the production of chemicals from natural gas and Kellogg has approached the problem from the standpoint of synthesizing liquid fuel and byproduct chemicals from natural gas. Test runs in the companies' pilot plants have demonstrated an improved control of quantity and quality of product and extension of length of runs to give appreciably greater on-stream efficiency. As a result, the manufacture of synthetic fuel from natural gas is now considered commercially sound."

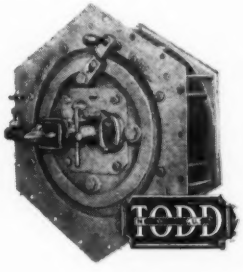
The statement highlighted four major points in the successful fulfillment of the work through many years: (1) Kellogg's pioneering and continuous development in this field since the middle 30's and their early application of fluid principle to the synthesis of liquid fuel; (2) Cities Serv-

OIL ALLOTMENTS GO FURTHER WITH TODD BURNERS

★

● Stretch your oil supply by replacing obsolete equipment with Todd Burners. Avail yourself of the years of experience of Todd engineers.

Oil Burners
Gas Burners
Combination Oil and Gas Burners



COMBUSTION EQUIPMENT DIVISION
TODD SHIPYARDS CORPORATION
81-16 45th Ave., Elmhurst, Queens, N. Y.

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HARRISBURG • YORK • CHICAGO • CHARLESTON, S. C. • BOSTON • SPRINGFIELD, MASS.
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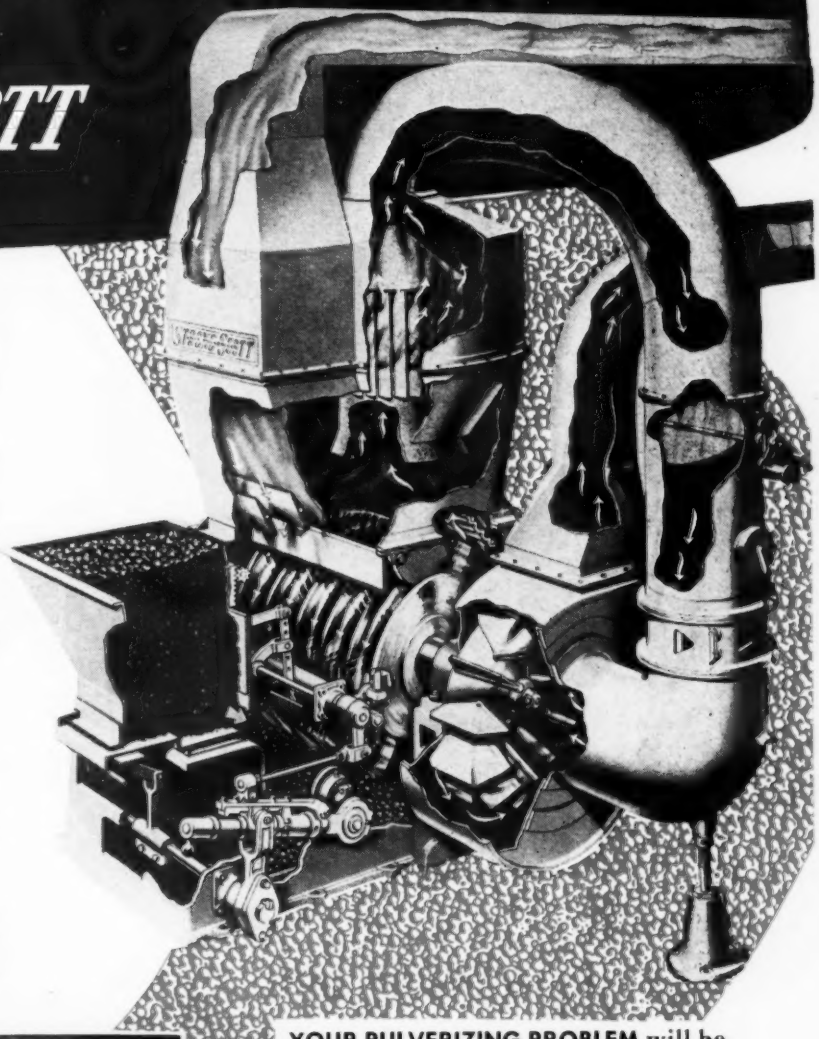
SEATTLE • MONTREAL • TORONTO
BARRANQUILLA • BUENOS AIRES • LONDON

Handle WET Coal BETTER

WITH

STRONG-SCOTT UNIT PULVERIZER

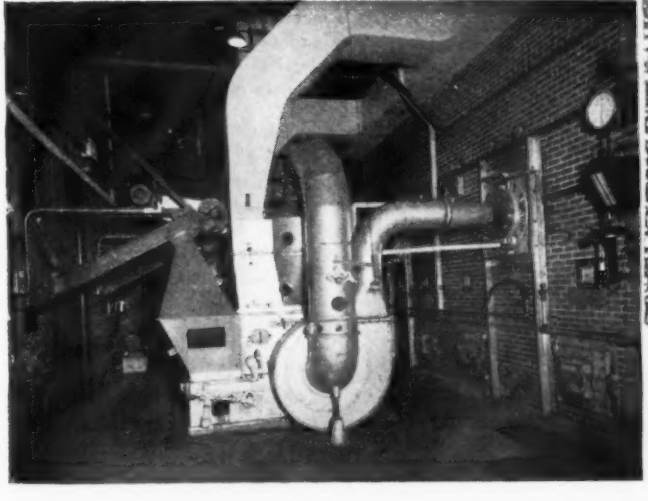


Wet or frozen coal dries faster in your STRONG-SCOTT Unit Pulverizer because much more preheated primary air passes thru its grinding chamber than thru any other unit pulverizer.

The non-clogging, automatic feeder delivers wet, sticky coal at any required rate, regularly and uniformly. When the fuel changes (in size, moisture-content, grindability, etc.), a simple hand adjustment maintains steady flow. Choking or stoppage is eliminated by a "floating" feeler bar on the fuel-level control.

Other Advantages

- *Pulverizes ANY bituminous coal* or by-product pitch by air-swept attrition.
- *Simple to Operate.* Can be made foolproof, with automatic controls for fuel-feed, and air supply.
- *Easy Maintenance.* Wide clearance in grinding chamber prevents damage from oversize lumps, tramp iron, rock, pyrites, slate, etc.



YOUR PULVERIZING PROBLEM will be solved by a staff of experienced combustion engineers when you consult STRONG-SCOTT. Every job is backed by 51 years of manufacturing experience—24 in the combustion engineering field.

VISIT one of our hundreds of installations in over 200 North American cities. Don't take our word for STRONG-SCOTT dependability—*see it with your own eyes.*

WRITE TODAY for Bulletin 341 for complete information. ***Names of users in your vicinity furnished on request.***

The STRONG-SCOTT Mfg. Co.

455 TAFT STREET N. E. • MINNEAPOLIS 13, MINN., U. S. A.

STRONG-SCOTT UNIT PULVERIZER

GET A LINE ON CLARK TRAPS

...and Vice Versa!

It Pays to Standardize on Clark–the Complete Line of Steam Traps!

40 YEARS OF EXPERIENCE PROVE THAT CLARK CONTROLS

Last Longer
Cut Maintenance Costs
Reduce Fuel Bills

If your production costs have been going up (and whose haven't) Clark can help you "hold the price line." The Heavier, Stronger construction of CLARK Controls makes for longer life and less frequent replacement. Our Engineering Department stands ready to help you on all fluid control problems.

Write today for details.

Write today for this free, helpful guide to more economical controls for your oil, steam and air lines.

THE CLARK MANUFACTURING CO.
1831 East 38th Street • Cleveland 14, Ohio

Clark
FLUID CONTROLS

ice's experience covering more than 20 years with chemistry of natural gas; (3) successful incorporation of advancements made by both companies in their latest pilot plants at Lake Charles, La., Tallant, Okla., and Jersey City, N. J., advancements which demonstrate the excellent economic possibilities of the process to date; and (4) continuation of joint research and development on a full scale pointing toward processing refinements that will even further improve economics of the process.

NAPE Mourns F W Raven, Secretary Emeritus

Fred W Raven, national secretary of National Assn of Power Engineers for 41 years and secretary emeritus since Sept 1943, died on March 11 after an extended illness. Born on Aug 8, 1864, at Haverhill, England, a short distance from London, he passed his 83rd birthday last Aug.

Raven joined NAPE as a charter member of Elgin, Ill. No. 49 when it was organized in 1896 and served as its president. He transferred to Ill. No. 1 of Chicago, when he moved to that city, where he again served as president. On his retirement, No. 1 elected him a life member. He was elected national secretary at the Boston National Convention in 1902 and served continuously for 41 years, retiring as secretary emeritus at National Conference in Buffalo in Sept 1943.

G L Knight, of Brooklyn Edison, Died March 27

George Laurence Knight, former vice-president of Brooklyn Edison Co and prominently known in engineering circles, died on March 27 in his home at 1 Harbor Lane, Brooklyn, N. Y. His age was 70.

A mechanical engineer, Knight was born at Haddonfield, N. J. He received his diploma from William Penn Charter School in Philadelphia and later was graduated from Drexel Institute.

He was a fellow in the American Society of Mechanical Engineers, and a member and past chairman of American Institute of Electrical Engineers. He belonged to the New York Engineers Club, and was a past president of the Brooklyn Engineers Club.

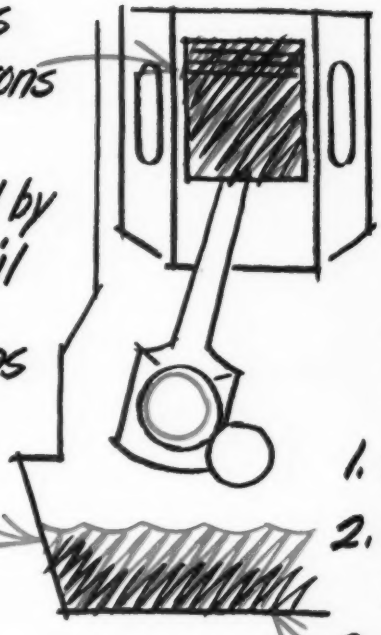
Westinghouse Electric Corp is building a revolutionary main-line railroad locomotive powered with a gas-turbine electric drive. The locomotive will incorporate much of the knowledge gained by Westinghouse engineers in designing and building jet-propulsion power plants for high-speed aircraft. A 2000-hp gas turbine, suitable for locomotive or industrial use, has demonstrated the soundness of its engineering design in more than a thousand hours of tests simulating actual operation conditions. On the basis of these tests, the company is proceeding to build two similar gas turbines for use in a locomotive. The axial-flow compressor is also being adapted to non-aircraft uses.

LUBE MEMO

Crankcase Sludge causes Hot Lube Oil troubles

Hot oil oxidizes fast, gums pistons

Sludge formed by ordinary lube oil insulates crankcase, keeps oil hot



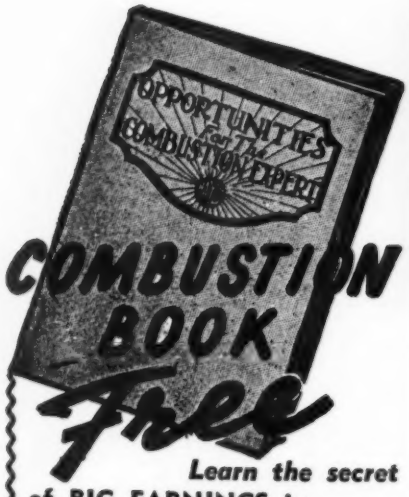
Foreman says try RPM DELO Diesel Engine Lubricating Oil – its compounds stop sludging 3 ways:

1. Oil oxidation slowed up
2. Gum and lacquer cleared out.
3. Contaminants held in suspension – flushed out when oil is changed.

Tell foreman OK to order RPM DELO Oil

DIESEL ENGINE RPM DELO LUBRICATING OIL

STANDARD OF CALIFORNIA • San Francisco, Calif.
THE CALIFORNIA COMPANY • Denver, Colo.
THE CALIFORNIA OIL COMPANY • New York
STANDARD OF TEXAS • El Paso, Texas



Learn the secret

of BIG EARNINGS in . . . . COMBUSTION ENGINEERING

There are plenty of good pay jobs in the power field today. Increase your earnings now—be a Hays-Trained Combustion Engineer. Just a little of your spare time required for the simple, easy-reading Hays Home Study Course. Hundreds of others have made better jobs for themselves through Hays training. So can YOU.

Approved for GI. Write for Free Book Now!

Hays Institute of Combustion
430 N. Michigan Ave., Chicago 11, Ill.
(Dept. 15) Our 28th Consecutive year

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(Dept. 15) Please send free book.
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Address .....
City..... State.....
Company Name .....

Makes ALL VALVES *INSTANTLY* Accessible

CONTROL FROM THE FLOOR

● **Instant, handy, safe control of overhead and other out-of-reach valves. Eliminate danger to employees; banish the stepladder. Now — install valves anywhere they should be, regardless of accessibility.**

Inexpensive BABBITT Sprocket Rims fit all types and makes of valves, with either rising or non-rising stems. Installed quickly by clamping directly onto hand wheel of valve. Eliminates makeshift apparatus and specially-made chain wheels.

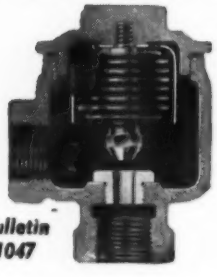
● **Ten standard sizes take care of all valve wheels from 2 to 30 inches in diameter.**

● ***Request Catalog Bulletin P, prices, name of local distributor:***

Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

BABBITT STEAM SPECIALTY COMPANY
Manufacturers of Adjustable Valve Operating Mechanisms
New Bedford, Mass., U. S. A.

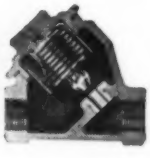
How to Keep Equipment FULL of Live Steam



Bulletin 1047

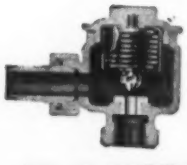
Prompt and full drainage of condensate and venting of air and non-condensible gases are among the most important factors in maintaining maximum heat in coils, kettles, etc.

Two reasons why Nicholson thermostatic traps prove superior in test after test: (1) operate on lowest temperature differential, 5° to 15°, depending on trap size and steam pressure. (2) 2 to 6 times average drainage capacity. We'll gladly send one for testing.



5 TYPES FOR EVERY APPLICATION—power, heat, process; size ¼" to 2"; pressure to 225 lbs. Bull. 1047 or see Sweet's.

5 Features of Nicholson Cylinder Control Valves



(1) Special seats, don't cut out. (2) Fast, positive acting. (3) Stuffing box easily repacked. (4) Heavy-bodied, withstand abuse. (5) Neat, installed in any position. For all mediums; press. to 5000 lbs.

W. H. NICHOLSON & CO. 125 OREGON STREET WILKES-BARRE, PA.

APPOINTMENTS

Bailey Meter Co announces that R B Ritschard has been transferred from Cincinnati to the Cleveland district office. Company is expanding its staff of field engineers. The following assignments have been made: (1) H E Bitler to its Buffalo office in Elliott Square Bldg (2) M J Bonnette and R W Hooper to Houston area, with headquarters at 6539 Brompton Rd (3) J W Cunningham to its Atlanta office at 184 Pryor St (4) H G Hilston to Cleveland district office (5) J O Meals to St. Louis office in Chouteau Trust Bldg (6) L W Meier to Los Angeles office at 1709 W 8th St (7) J R Brennan, J A Hays and R P Marche are remaining at Cleveland main office where they will be attached to engineering, research and sales departments, respectively.

Globe Machinery & Supply Co, Des Moines, has been appointed distributer for **Parker Appliance Co,** Cleveland.

Peerless Pump Div, Food Machinery Corp, has opened a New York office at 37 Wall St to handle Atlantic district sales. R C Engemoen has been made district manager in New York.

O B Wilson has been named industrial manager for eastern sales region of **Brown Instrument Co,** div of Minneapolis-Honeywell Regulator Co. Wilson's promotion makes him regional manager of territory extending from northern Va., through eastern Pa., to the Canadian border, west to Rochester, N. Y., and in New England. He will continue to make his headquarters in New York City.

Combustion Engineering Co, New York City, has appointed John Van Brunt vice-president and consulting engineer. Wilbur H Armacost succeeds Van Brunt as vice-president in charge of engineering.

E J McMahon, production manager of **Dearborn Chemical Co,** has been elected a director and vice-president. He succeeds John W Brashears, who retired as an honorary director for life. Frank A Jones has been appointed chief engineer, with headquarters at general offices, 310 S Michigan Ave, Chicago. He will supervise all engineering activities, foam-meter equipment and development of new equipment. E A Goodnow, whom he succeeds, has relinquished his position because of ill health, but he will remain with the company as assistant chief engineer. Gordon E MacLean has joined the sales dept. He has been assigned to Indianapolis office with a territory including Ky., Tenn. and Ala.

Link-Belt Co has established its own sales office in Louisville, with headquarters at 136 S 4th St, Louisville 2. Emmart LaCross Jr has been appointed district sales manager in charge of the new office. Herschel O Smith will assist him. A district sales office has been established in Charlotte, N. C., with headquarters at 617 Johnston Bldg, Charlotte 2. Thomas H Appleton has been named district sales manager of this new office. To better serve customers in state of Del., the company

NOT A BRAND,

BUT A BRAND PROTECTOR

"CIRCLED R"

TIMKEN ®

It tells the world that "TIMKEN" is registered as a trade-mark in the United States Patent Office and cannot lawfully be used to designate products other than those manufactured by The Timken Roller Bearing Company — Timken Tapered Roller Bearings, Timken Alloy Steels, Timken Seamless Steel Tubing and Timken Rock Bits.

The trade-mark "TIMKEN" is the buyer's assurance of the finest products in their respective fields. Look for it. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

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TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION ✳

PROTECT AIR TOOLS FROM MOISTURE DAMAGE

● Condensation of water in your air lines washes out the lubricating oil and causes expensive damage to air tools and pneumatically-operated equipment.

This condensation occurs when the temperature of the air surrounding your lines and tools falls below that of the compressed air. Ordinary cooling with surface water does not prevent this, but it is prevented by the Niagara Aero After Cooler which always cools below the dry bulb temperature of the surrounding air.

In addition, the Niagara After Cooler saves you the cost of water in cooling and pays for itself in a short time.

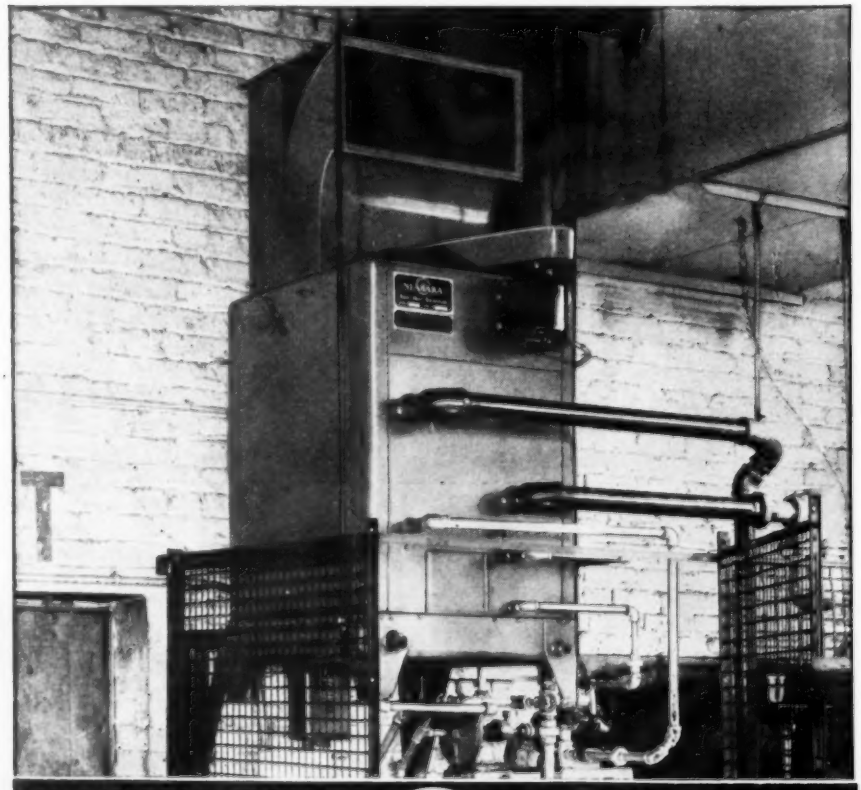
Write for Bulletins 96-P and 98-P

NIAGARA BLOWER COMPANY

Over 30 Years of Service in Industrial Air Engineering

405 Lexington Ave. New York 17, N.Y.

District Engineers in Principal Cities



INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

has established a district sales office in Wilmington, with headquarters at 805 Orange St, Wilmington. William H Kinkead has been made district sales manager.

Haskell C Carter has been named vice-president in charge of manufacturing of **Iron Fireman Mfg Co.** The new position makes Carter supervisor of production for Iron Fireman's plants at Portland, Cleveland and Toronto, Canada.

General Electric Co has appointed John O Wiley its representative for conduit products in Ind. and northern Ill. Charles H Harris has become manager of new Decatur, Ill., works of plastics div. Randolph P Rice has been made manager of industrial div, apparatus dept, for GE in New England. His headquarters will continue to be at Boston. Four new appointments in recently organized aircraft, federal and marine divisions of apparatus dept have been announced: J C Wheeler is now administrative assistant to the divisions' manager and William C Elcan has been appointed manager of ordnance sales div. In aviation div, Edward G Haven has been named manager and Robert A Averitt assistant manager. Alexander Kennedy Jr is still engineering assistant to the divisions' manager and Warren E Hoffman continues as manager of land equipment div. In marine div, Earl K Henley is manager and William H Wild, manager of sales. Royce A Beekman is manager of federal and marine engineering divisions.

John W Anne has been made sales manager of Jeannette plant of **Elliott Co.**

Allis-Chalmers Mfg Co has elected James M Barker, of Chicago, chairman of boards of Allstate Insurance Co and Allstate Fire Insurance Co, to board of directors. Barker replaces Alfred J Kieckhefer, who has resigned. W A Roberts and W C Johnson, executive vice-presidents of Allis-Chalmers, have been appointed to executive committee of board. They replace Kieckhefer and the late Herman W Falk. John R Queen has been named dealer supervisor at New York for the company's Empire region. Territory embraced by Empire region is covered by district offices in New York, Buffalo, Newark, Rochester and Syracuse. David R Boise has been made manager of Amarillo district office. F Harvey Searight retired Mar 31 after 37 years association with Allis-Chalmers on West Coast. James Wilson has retired as manager of field engineering section of steam turbine dept after 43 years of service.

R F Teeling of Manhattan Rubber Div, **Raybestos-Manhattan, Inc,** Passaic, N. J., has been appointed manager of local sales branch formerly known as N. J. sales and now known as N. J. branch.

Westinghouse Electric Corp has named L H Gillette as manager, heating section sales, transportation and generator div. Gillette is headquartered in Meadville, Pa. Appointment of two sales executives for central district office in Pittsburgh has been announced: Charles H Weaver has been made industrial manager and Quincy

(*Continued on page* 186)

Reader Service Page for . . .

NEW EQUIPMENT and TECHNICAL LITERATURE

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

NEW PRODUCTS & MATERIALS

See pages 118-122, 136, 158-168

Lightweight Pumps ..... page 118
Radiation Pyrometer ..... page 118
Vertical Gearmotor ..... page 118
Dial Thermometer ..... page 118
Water Purifier ..... page 118
Horizontal Diesel Engine ..... page 118
Wound-Rotor Motor ..... page 120
Humidifier Unit ..... page 120
Portable Extension Cord ..... page 120
Pipe Wrench ..... page 120
Pump Packings ..... page 120
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Portable Repair Shop ..... page 136
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MANUFACTURERS' BULLETINS

See pages 176b-184

Air Conditioning, Heating, Refrigeration, Ventilating ..... page 176b
Boilers and Auxiliares ..... page 176b
Controls, Electric ..... page 176b
Electric Equipment ..... page 176b

(Turn over for bulletin items)

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

Write here number of item in which you are interested → E17

Your Company Name... Brown Mfg. Co.

Address... 3718 First Avenue, Pottsville, Okla.

Your Name... John Smith

Your Title... Power Engineer

POWER, 330 West 42nd St., New York 18, N. Y.

FILL OUT AND MAIL TODAY! NOT GOOD AFTER AUG. 1, 1948

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Address.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 5/48

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Your Title.....

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Maintenance and Safety Equipment ..... page 178
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Materials Handling ..... page 178
Mechanical Transmission ..... page 180
Metals and Alloys ..... page 180
Piping, Fittings, Valves and Specialties ..... page 180
Prime Movers and Accessories ..... page 182
Water Treatment ..... page 182
Welding ..... page 184
Other Equipment ..... page 184

AIR CONDITIONING, HEATING, REFRIGERATION AND VENTILATING

1 STEAM-VACUUM REFRIGERATION—Graham Mfg Co, 415 Lexington Ave, New York 17, N. Y. 4-page leaflet No. 868 describes steam-vacuum refrigeration for cooling water down to 40 F. Operation and installation of this system are discussed.

2 TUBE-ICE MACHINE—Henry Vogt Machine Co, 1000 W Ormsby St, Louisville 10, Ky. 16-page bulletin No. T1-2 discusses Vogt automatic tube-ice machine, the process and product Vogtice.

3 EVAPORATORS—Zaremba Co, Crosby Bldg, Buffalo, N. Y. 80-page catalog presents technical features of Zaremba evaporators. This catalog gives applications and advantages of various evaporator designs, including modernized versions of older types as well as latest developments.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★AIR RECOVERY EQUIPMENT—W B Connor Engrg Corp, 114 E 32nd St, New York 16, N. Y. 16-page bulletin No. 105-A contains complete information on construction, selection and application of Dorex Type H air recovery units.

BOILERS AND AUXILIARIES

4 ECONOMICAL STEAM GENERATION — Engineering-Research Div, Ohio Coal Assn, Rockefeller Bldg, Cleveland 13, Ohio. 16-page brochure, entitled "Saving the Fuel Dollar," serves as a helpful guide to power-plant designers, operators and owners in selection of equipment that will help save fuel dollars.

5 BOILER DESIGN—Babcock & Wilcox Co, 85 Liberty St, New York 6, N. Y. Paper, entitled "Recent Boiler Design Practice," discusses important factors that influence design of steam-generating equipment.

6 COMBUSTION SAFEGUARD — Combustion Control Corp, 77 Broadway, Cambridge 42, Mass. Bulletin No. FF-1 introduces photoelectric scanner Type 45Ph5 for flame failure protection on oil burners.

CONTROLS, ELECTRIC

7 FEEDER VOLTAGE REGULATOR—Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 24-page bulletin No. 01B6065A describes operating and construction features of the Allis-Chalmers transformer-type DFR 5/8% step feeder voltage regulator.

8 THERMOSTATS AND ENGINEERING SERVICE—Westinghouse Electric Corp, Meadville, Pa. Leaflet No. B-3954 explains how "therm-a-neering" service provides thermal and electrical engineers and a well-equipped development laboratory to assist the manufacturer in handling problems of heat and its application. Leaflet No. B-3939 discusses the advantage of three of the Westinghouse line of thermostats. Leaflet No. B3938 covers the Clostemp thermostat.

9 DC AND AC RELAYS—Allied Control Co, 2 E End Ave, New York 21, N. Y. Catalog gives descriptions and ordering specifications of Allied line of dc and ac relays.

10 OPERATION RECORDERS—Esterline-Angus Co, Box 596, Indianapolis 6, Ind. 16-page bulletin No. 247 discusses selection and use of Esterline-Angus operation recorders.

ELECTRICAL EQUIPMENT

11 DISTRIBUTION TRANSFORMERS—Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 12-page bulletin No. 61B6159A describes Allis-Chalmers improved line of distribution transformers, 100 kva and below, 15,000 v and below.

12 TOTALLY ENCLOSED MOTOR—Burke Electric Co, 273 W 12th St, Erie, Pa. 4-page bulletin No. NAF-1 discusses Burke Type NAF totally enclosed fan-cooled squirrel-cage induction motors.

13 MOTOR GENERATORS—Motor Generator Corp, Box DM-785, Troy, Ohio. 4-page folder presents complete line of MGC products, such as motor generators, materials handling equipment, air compressors, battery chargers, etc.

14 WIRE SPLICE—Burndy Engrg Co, 107 Bruckner Blvd, New York 54, N. Y. 8-page bulletin No. 48Y1 describes beryllium copper-lined Hysplices for overhead lines.

15 COMMUTATOR BRUSHES — Keystone Carbon Co, 1935 State St, St. Marys, Pa. 4-page folder, entitled "Keystone Precision Molded Products for the Electrical Industry," covers Keystone slip ring and commutator brushes, negative temperature coefficient resistance units, powder metal parts and Selflube bearings.

16 BUILDING WIRE—Hazard Insulated Wire Works Div, Okonite Co, Wilkes-Barre, Pa. 48-page bulletin No. H-403, entitled "Hazard Building Wires," contains full descriptions and specifications for various insulations used in Hazard building wires, together with recommendations for their use. A section is devoted to valuable engineering data for added convenience in planning new wiring and rewiring of electrical installations.

17 COMBINATION STARTER—Electric Machinery Mfg Co, Minneapolis 13, Minn. 8-page bulletin No. 3100-PRD-192 discusses features of Hi-Fuse control for motor operation and protection.

18 MAGNETIC SEPARATOR LABORATORY—Dings Magnetic Separator Co, 4740 W McGeogh Ave, Milwaukee 14, Wis. 4-page bulletin No. 1120 describes operation of this company's laboratory in solving separation problems in many indus-

(*Continued on page 178*)

FIRST CLASS
PERMIT No. 64
(Sec.510.P.L.&R.)
NEWYORK,N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

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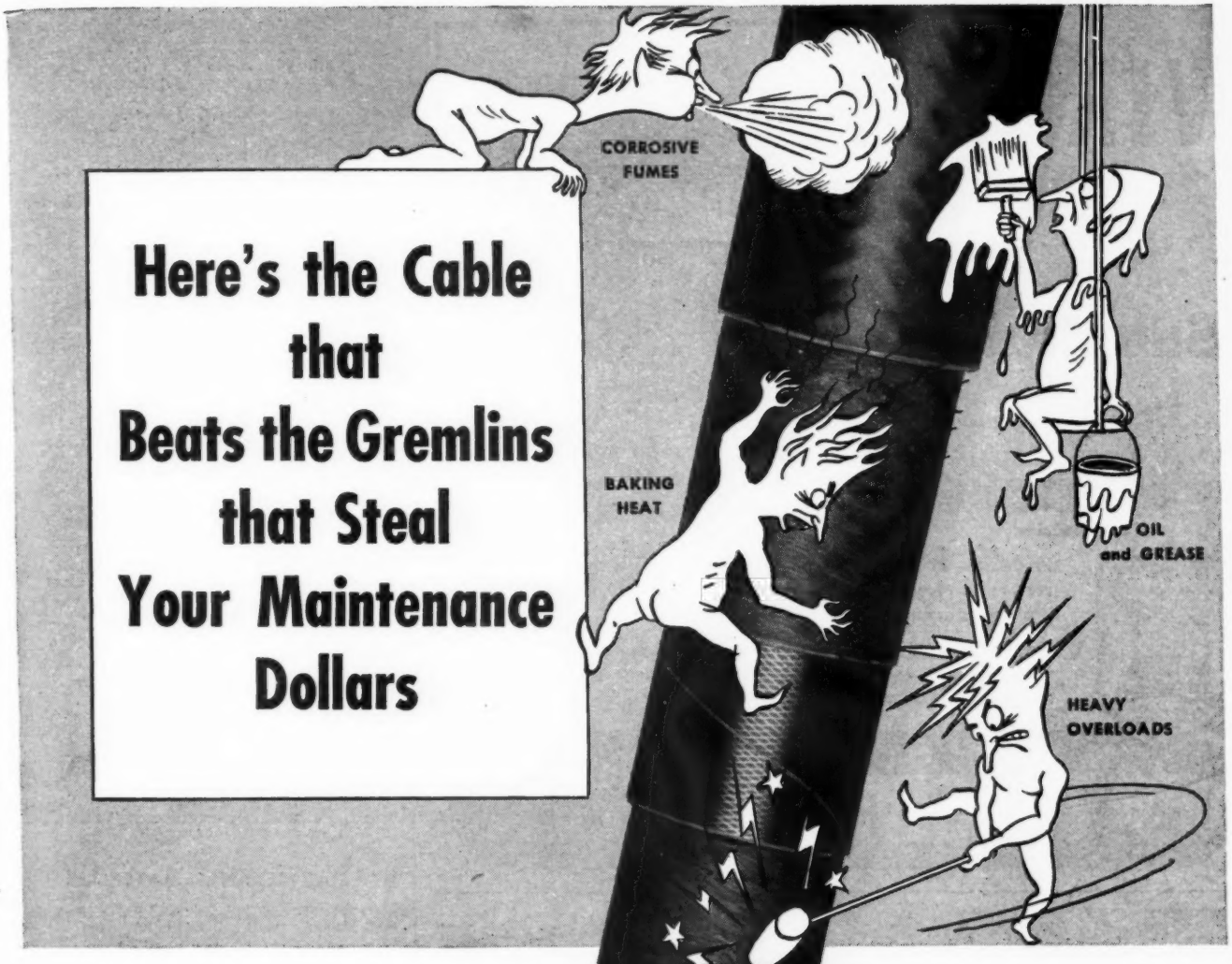


Here's the Cable that Beats the Gremlins that Steal Your Maintenance Dollars

We're sure you've met the gremlins. They're the little fellows who cause the wire failures that cost you so many nightmares. But you can beat them to the punch with *permanently insulated* Rockbestos A.V.C.

For here's the cable that gives you assured trouble-free service, saves maintenance costs for you every day through all of its long dependable life.

Because it's permanently insulated with *impregnated asbestos*, Rockbestos A.V.C. won't rot or bloom when exposed to fumes, grease or oil . . . won't bake brittle when exposed to constant high temperatures up to 230° F. . . . won't break down (where others so often do!) when exposed to severe heating and cooling cycles in conduit.

Select your circuit protection from 125 Rockbestos wires and cables in 300 to 5,000 volt ratings. If you desire, the Rockbestos engineer in our nearest district office will make recommendations. Write him or write direct.

Why ROCKBESTOS A.V.C. Keeps Circuits Operating Under Severe Conditions

- A tough, non-aging impregnated asbestos braid resistant to heat, flame, moisture, grease, oil and corrosive fumes.
- An outer wall of impregnated felted asbestos that won't dry out, crack, flow, rot or burn —also protects varnished cambric beneath from heat and oxidation.
- Varnished cambric for high dielectric strength and added moisture resistance.
- An inner wall of heat and flame resistant impregnated asbestos which acts as a baffle between the varnished cambric and hot conductors.
- The conductor is perfectly and permanently centered in non-flowing heat resistant insulation that provides greater current carrying capacity.

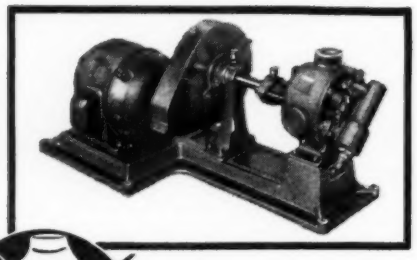
ROCKBESTOS PRODUCTS CORP., 630 NICOLL ST., NEW HAVEN 4, CONN.

NEW YORK BUFFALO CLEVELAND DETROIT CHICAGO
PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CALIF.

WRITE TODAY—for your copy of the new No. 10-F Catalog, sectioned for easy reference to permanently insulated Lighting Wires, Power & Control Cables; Apparatus Wires & Cables; Switchboard, Appliance, Fixture, Electronic and Magnet Wires.

ROCKBESTOS A.V.C. *The Wire with Permanent Insulation*

VIKINGS IN...



Substitutes ...OUT!

The substitute era of war-time shortages is drawing to a close. Once again Viking, the pump built *for* your job, is becoming more readily available.

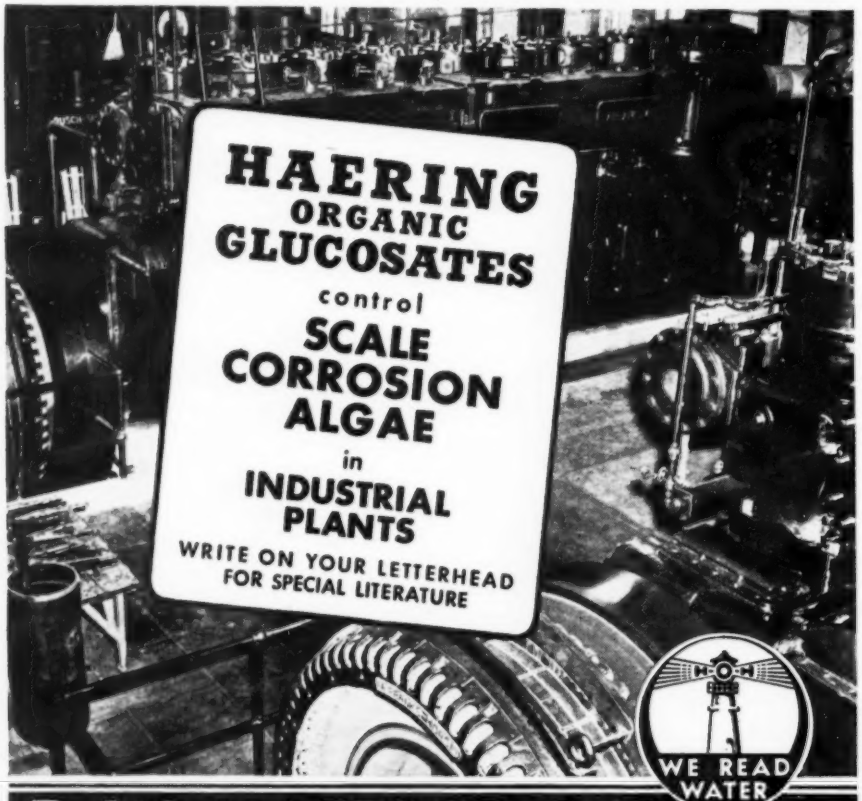
A few are still on the shortage list. However, every effort is being made to vastly increase production of these models. The result is progressively earlier schedules.

Production is up—away up—higher than at any time in the company's record. But please don't forget, quality, at no time, has been sacrificed for higher production.

Buy Viking with assurance of the same dependable "gear within a gear" quality. First in the rotary pump field. Write today for free bulletin 47SW.

See Our Catalog In SWEETS

Viking Pump Company
Cedar Falls, Iowa



D. W. HAERING & CO., Inc.
GENERAL OFFICES:
205 West Wacker Drive, Chicago 6, Illinois

tries. Purpose of laboratory, whose service is free, is to analyze materials to determine if, and how best, they can be magnetically separated and to develop new and improved separators.

19 WIRE AND CABLE—Appliance & Merchandising Dept, General Electric Co, Bridgeport 2, Conn. 48-page catalog lists all the GE thermoplastic, braided and leaded building wires, BX cable, entrance cable, Braid X and PVX cables, as well as complete line of Flamenol, neoprene, rubber, and braided cords and portables.

20 MOTORS AND COUPLINGS—Crocker-Wheeler Div, Joshua Hendy Iron Works, Ampere, N. J. 8-page bulletin No. SP-1B contains prices and dimensions of most commonly used ac and dc motors, in sizes from ½ to 75 hp. Control prices, net weights of motors and accessories, and prices and dimensions of flexible couplings are shown in chart form.

MAINTENANCE AND SAFETY EQUIPMENT

21 TUBE CLEANERS—Airetool Mfg Co, 334 S Center St, Springfield, Ohio. 6-page bulletin No. 40 describes features of three models of Airetool tube cleaners for condensers and heat exchangers.

22 UNIVERSAL METAL WORKER—Versa-Mil Co, 30 Church St, New York 7, N. Y. 8-page bulletin pictures numerous metal-working operations with single machine attachment—milling, drilling, boring, facing, internal and external grinding and surfacing. Many maintenance applications are given.

23 PIPE AND STUD EXTRACTORS—Reps Tool Co, Hartford, Conn. 4-page booklet No. WK-25M-747 covers operation of Reps pipe and stud extractors. Features and applications are included.

24 LINE LOCATOR—Wilkinson Products Co, P O Box 1774, Wilshire-La Brea Station, Los Angeles 36, Calif. 4-page booklet describes design and construction of Wilkinson line locator.

MAINTENANCE MATERIALS

25 WOOD PRESERVATIVE PAINT—Speco, Inc, 3142 Superior Ave, Cleveland, Ohio. 4-page booklet presents Woodtrem, which is reputed to prevent rot and decay and to be especially adapted for wood that is to be buried in the ground or laid on an earth surface.

26 LEAK SEALER—Flexrock Co, Filbert and Cuthbert, West of 36th, Philadelphia 4, Pa. Folder describes Flextite, a liquid chemical for stopping leaks. When used for mixing cement or cement and sand, it results in a mortar that will do many difficult and unusual jobs.

27 FLOOR PATCH AND RESURFACER—Flexrock Co, Filbert and Cuthbert, West of 36th, Philadelphia 4, Pa. 4-page booklet gives directions for applying Trowel-In floor patch and resurfacer.

28 RUST-PREVENTIVE PAINT—Speco, Inc, 3142 Superior Ave, Cleveland 14, Ohio. 6-page leaflet gives advantages of Speco Rustrem paint, available in black or aluminum. It can be applied right over rust without brushing or scraping.

29 HEAT-RESISTING ALUMINUM PAINT—Speco, Inc, 3142 Superior Ave, Cleveland 14, Ohio. Literature describes Heatrem, a new high heat-resisting aluminum paint, made specifically for use on exterior and interior metal surfaces where temperatures reach 1500 F, or any wood, brick or concrete surfaces exposed to extreme heat.

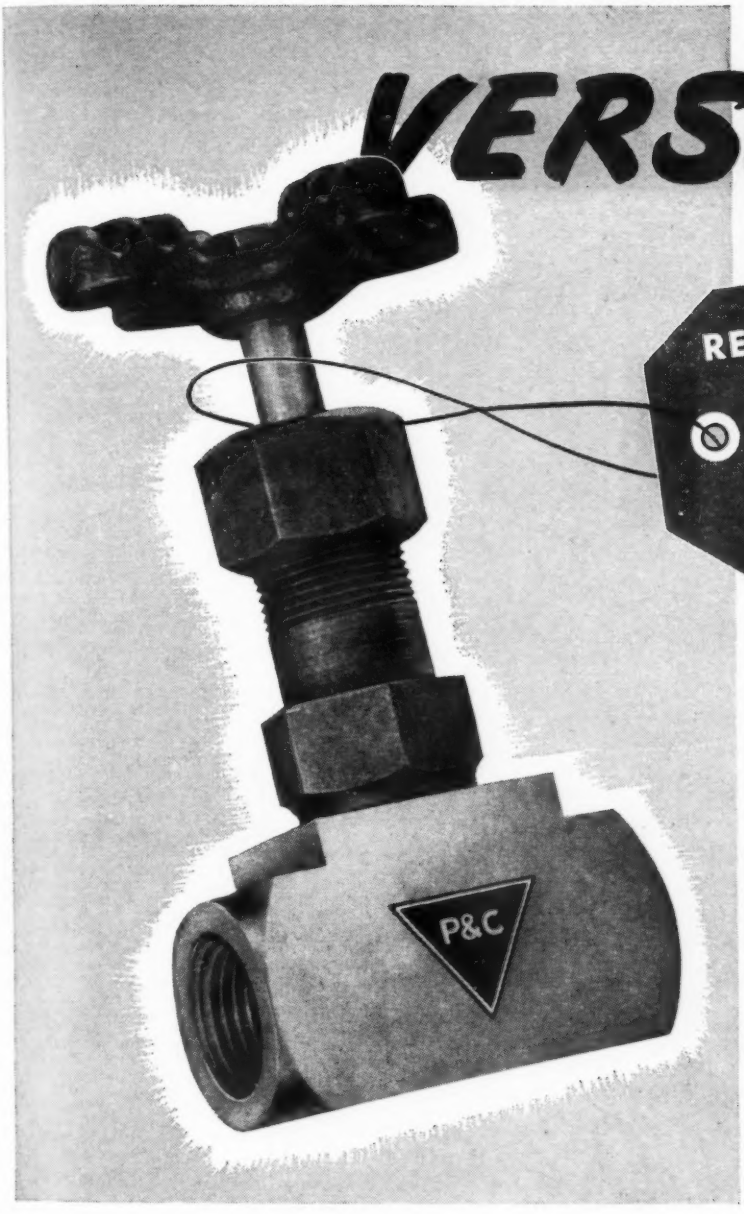
MATERIALS HANDLING

30 VIBRATING SCREEN—Robins Conveyors Div, Hewitt-Robins Inc, Passaic, N. J. 4-page bulletin No. 122-A describes Style M Vibrex screen. Applications and full range of sizes in single- or double-deck styles are included.

31 CONVEYOR BELTS—B F Goodrich Co, Akron, Ohio, 4-page catalog section No. 2220 explains yardsticks employed in belt engineering to differentiate grades, pictures and describes the conveyor belts in its line, cites the common application for each and also devotes a page to special constructions obtainable in the various grades.

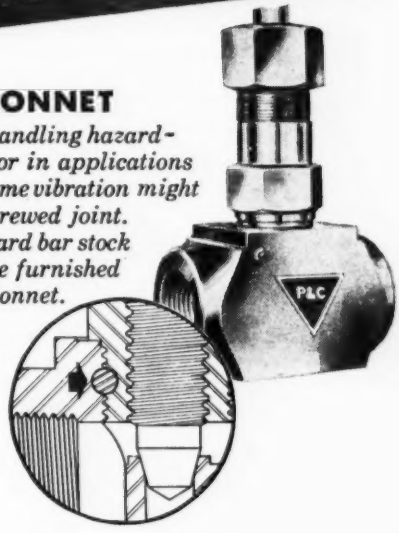
VERSATILE

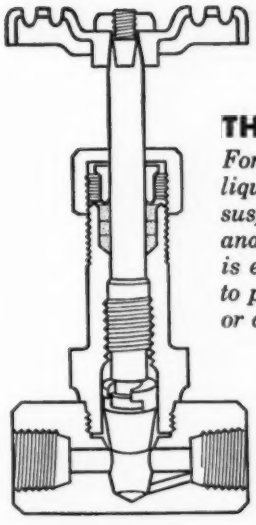
READING-PRATT & CADY BAR STOCK VALVES



LOCK BONNET

For lines handling hazardous fluids or in applications where extreme vibration might loosen a screwed joint. Any standard bar stock valve can be furnished with lock bonnet.





THRU-PORT

For handling heavy liquids which carry suspended solids and where trouble is encountered due to precipitates or deposits.

BAR STOCK GLOBE AND ANGLE VALVES were first introduced by Reading-Pratt & Cady as close control valves. Today they are made in globe, angle and thru-port types, screwed end, welding end or union end, regular screwed bonnet, or lock bonnet. They have in fact become general purpose valves.

They are precision-machined from highest quality bar stock—bronze, carbon steel or alloy steel. Working pressures range from 4000 pounds at 150° F. to 475 pounds at 1000° F.

Send for our new catalog which describes Bar Stock Valves. Write for DH-766.

ACCO

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TRADE MARK

READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

READING-PRATT & CADY VALVES

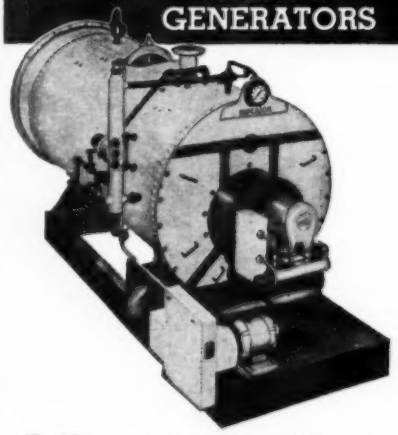
The IMO Pump can be operated at motor and turbine speeds. It is ideal for direct connection and integral mounting. Excepting for the flow and vaporization characteristics of the fluid being pumped, there's practically no limit to the speed at which an IMO Pump can be operated.

IMO Pumps can be furnished for practically any capacity and pressure required for oil, hydraulic-control fluids and other liquids.

Send for Bulletin 1-147P

IMO PUMP DIVISION of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

SUPERIOR
STEAM
GENERATORS



Fully automatic with any grade of oil. 17 sizes from 20 to 500 b.h.p. for pressures up to 200 p.s.i. Require no expensive chimney, supply their own induced draft. 80% thermal efficiency guaranteed. Write today for catalog 101.

Superior Combustion Industries, Inc.
Factory: Emmaus, Pa.
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MERCOID

The Only 100% Mercury Switch Equipped Controls

FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS INDUSTRIAL APPLICATIONS

Mercury switches are the most advanced means for "making" and "breaking" an electrical circuit. They are not affected by dust, dirt or corrosion.

See catalog No. 600 for description of complete line

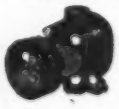
DA PRESSURE CONTROLS

Industries' first choice for dependable control performance. The outside adjustment and visible dial eliminate all guesswork when setting the operating range.

MERCURY SWITCHES

Mercoid brand switches are noted for their superior operating qualities. Various types available.

LIQUID LEVEL CONTROLS



Available for gasoline, oil, ammonia or other low specific gravity liquids. Also for liquids at high pressures.

TEMPERATURE CONTROLS

Used on a variety of industrial temperature applications. Have same adjustment feature described above.

FLOAT CONTROLS

Used for maintaining fluid levels in tanks or for control of sump pumps, etc. Two types, the counter-balance type and plunger type available.

THE MERCOID CORPORATION, 4203W. BELMONT AVE., CHICAGO 41, ILL.

32 WIRE ROPE—Dept 711, Wire Rope Institute, 1044 Shoreham Bldg, Washington 5, D. C. 119-page catalog, entitled "Wire Rope," contains useful information in selecting, buying and using of wire rope.

33 ELEVATOR ENTRANCES — Art Metal Construction Co, Jamestown, N. Y. 6-page bulletin No. B-707 gives specifications for single-slide and hinged-panel elevator entrances. 6-page bulletin No. B708 describes single-slide elevator entrances. 6-page bulletin No. B-709 gives advantages of 2-speed elevator entrances.

34 MATERIALS - HANDLING ELEVATORS—Otis Elevator Co, 260 Eleventh Ave, New York 1, N. Y. 4 page reprint, entitled "Elevators for Materials Handling," discusses subject of careful planning for proper elevator installation for a materials-handling job. 4-page booklet No. B-639 describes elevator car design No. 164. Bulletin No. B-652 discusses features of Otis dial indicator fixture for use with duplex collective control elevators that operate in banks of two.

MECHANICAL TRANSMISSION

35 COUPLING UNITS—Ever-Tite Coupling Co, 254 W 54th St, New York 19, N. Y. 8-page booklet covers Ever-Tite line of coupling units.

36 SPEED CONTROL—Reeves Pulley Co, Columbus, Ind. Folder describes three Reeves speed control units—Reeves variable speed transmission, Vari-Speed motor pulley and Motodrive.

37 MANGANESE STEEL CHAIN—American Manganese Steel Div, American Brake Shoe Co, Chicago Heights, Ill. 28-page bulletin No. 742-CN discusses advantages and ultimate economy of manganese steel chain for tough jobs involving shock and abrasion.

38 BEARING LOAD—Advertising Dept, New Departure Div, General Motors Corp, Bristol, Conn. Booklet, entitled "Bearing Load Computation," explains process of computing bearing reactions, using the three conditions of equilibrium.

39 CORD BELTING—B F Goodrich Co, Akron, Ohio. 2-page catalog No. 2140 covers Multi-Cord belting for the severest drives.

40 SPEED CHANGERS—Metron Instrument Co, 432 Lincoln St, Denver 9, Colo. 4-page bulletin No. 100 describes miniature speed changers for instruments, controls, regulators or any small power devices.

41 BACKSTOP—Falk Corp, 3001 W Canal St, Milwaukee 8, Wis. 4-page bulletin No. 10,080 presents easy-to-read information on construction and operating advantages of the Falk backstop. This new Falk backstop provides a positive method for preventing a reverse rotation on conveyor drives, elevator head shafts, etc.

METALS AND ALLOYS

42 BORON ALLOY—Norton Co, Worcester 6, Mass. 4-page booklet gives facts about Norton Boron Master alloy, a chemically balanced alloy of boron and iron for adding boron to steel and cast iron.

43 STEEL ANALYSIS CHART—Globe Steel Tubes Co, Milwaukee 4, Wis. Corrosion- and heat-resisting steel analysis chart tabulates a large variety of stainless steels produced by many steel mills. This tabulation shows chemical analysis of most of the stainless steels produced and usually available.

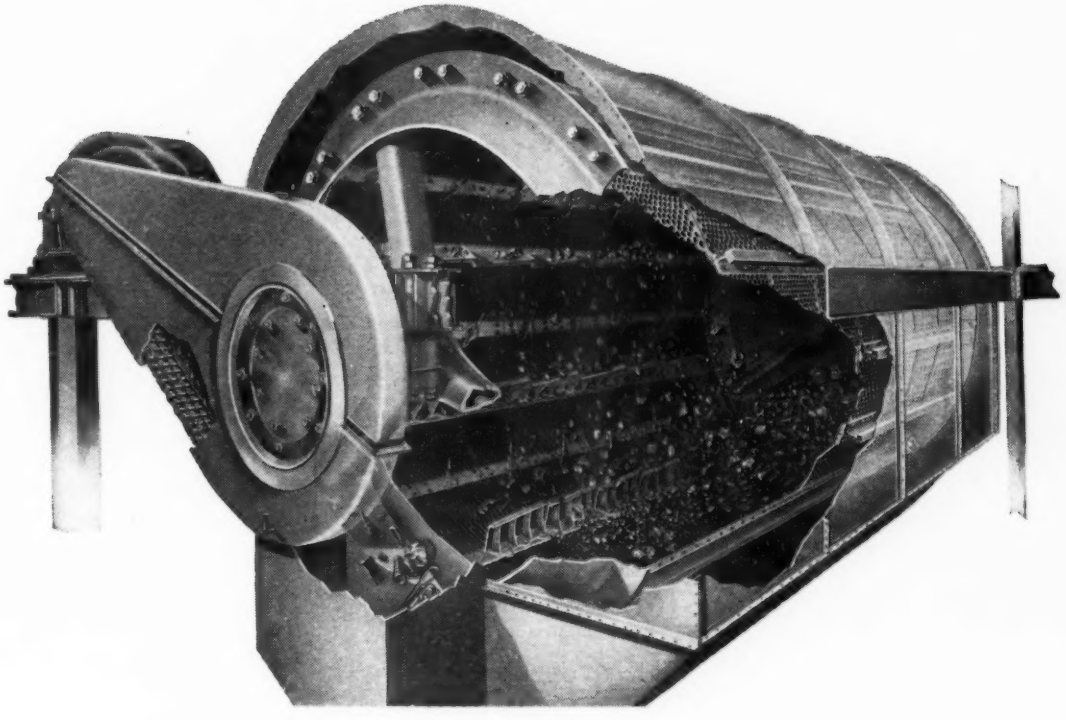
44 NICKEL ALLOY STEELS—International Nickel Co, 67 Wall St, New York 5, N. Y. 26 page booklet describes properties of heat-treated wrought nickel alloy steels. This booklet discusses heat-treatment methods, both for carburizing and direct-hardening compositions, along with suggested applications.

PIPING, FITTINGS, VALVES AND SPECIALTIES

45 FLUSH VALVES—Imperial Brass Mfg Co, 1200 W Harrison St, Chicago, Ill. 20-page manual No. 8560W, entitled "Keep 'Em Flushing," contains helpful information on operation and maintenance of flush valves.

"PENNSYLVANIA" STEELBUILT

BRADFORD BREAKERS at the POWER STATION



Prepare Uniform Steam Coals . . .
Without Oversize . . . with Minimum Fines

The flexibility and dependability of the "Pennsylvania" Bradford make it the ideal power station crusher. It has the flexibility needed to handle rail, tidewater and storage coals, soft, medium and hard, from all sources, at all seasons of the year. It is a dependable scavenger—protects stokers, pulverizers and conveyors from mine refuse, tramp iron and other debris. Its stamina and dependability make single unit installations sound engineering practice. In fact, more than 65% of all "Pennsylvania" Bradfords in central station service are single units, the multiple units in most cases being installed for capacity reasons. Such reliance on a single piece of equipment at an important Central Station was unthinkable prior to the "Pennsylvania" . . . is the sincerest tribute to the engineering skill and massive construction that go into this unit.

At the power station it is often necessary to reduce wet coals, from barges or stock piles. In temperate zones such coals will be frozen for weeks and months at a time. For such services the "Pennsylvania" is supplied with "Laclede Special" screen plates which have somewhat increased screening capacity on dry coals and are practically non-clogging and self-cleaning when handling wet or frozen coals.

This unit has become almost the standard primary crusher at power stations throughout the country because of its dependability in service, the unusually small amount of power required, the negligible amount of maintenance and servicing necessary and the fact that the delivered product is completely free from oversize and all refuse larger than the screen perforations.

"Pennsylvania" Steelbuilt Crushers are first choice in Power Plant and Coking Plant equipment, here and abroad. Types and capacities to meet all requirements. Inquiries are invited.

PENNSYLVANIA CRUSHER COMPANY

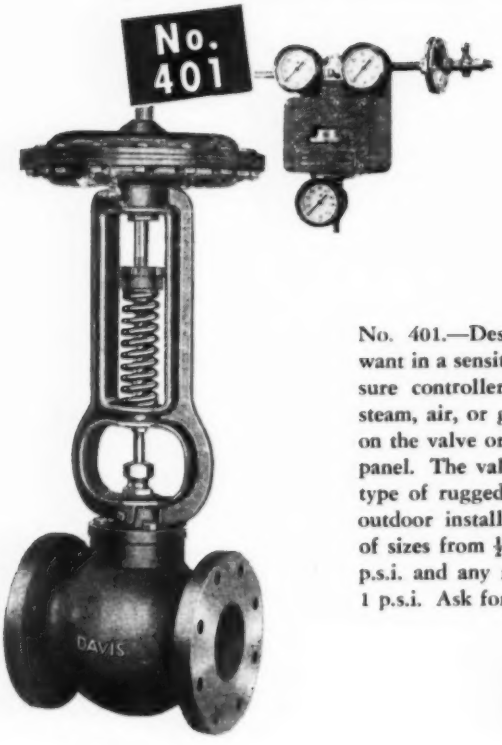
Liberty Trust Bldg., Philadelphia 7, Pa.

New York • Pittsburgh • Chicago • Los Angeles • Birmingham

Associated with Fraser & Chalmers Engineering Works, London

—everything YOU want in

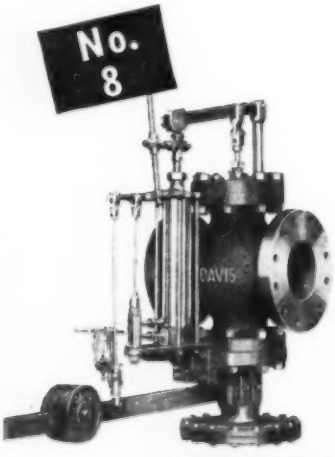
PRESSURE REGULATORS



The DAVIS Line is Complete!

No. 401.—Designed to give you everything you want in a sensitive diaphragm motor valve and pressure controller for pressure reducing service on steam, air, or gas. The controller may be mounted on the valve or installed remotely on an instrument panel. The valve is a spring loaded, balanced disc type of rugged construction suitable for indoor or outdoor installation. Offered in a complete range of sizes from ¼" to 10" for initial pressures to 600 p.s.i. and any reduced pressure from 500 down to 1 p.s.i. Ask for descriptive literature.

No. 40—This is a simple, self-contained, pilot operated type reducing valve for handling heavy, variable loads on steam or air. Unaffected by high pressure fluctuations, pressure reduction is maintained regardless of flow conditions. Full pipe size port area gives large capacity; single seat insures tight closing. Sizes from ¼" to 6". Available in materials suitable for any initial pressure up to 400 p.s.i.



No. 8.—Built for handling steam at pressures ranging as high as 600 p.s.i. Pilot controlled and weight loaded, with auxiliary operating cylinder, this valve provides exceptionally accurate regulation for reduced pressures from 0 to 300 p.s.i. Sizes from 2" to 24".

Let Davis help you get the right regulator for the job. The Davis line is complete . . . 18 types to choose from . . . ask for Bulletin No. 100 A.

DAVIS REGULATOR COMPANY

2540 So. Washtenaw Ave., Chicago 8, Ill.

46 FORGED-STEEL VALVES—Ohio Injector Co, Wadsworth, Ohio. 16-page catalog describes OIC line of forged-steel valves in gates, globes, angles and checks with various types of trim.

47 INSULATED PIPE CONDUIT SYSTEMS—Ric-WiL Co, Cleveland, Ohio. 4-page booklet No. 4625 discusses insulated pipe conduit systems for distribution and insulation of steam, oil, or hot water.

48 BUTTERFLY VALVES—Dept DH, R-S Products Corp, Wayne Junction, Philadelphia 44, Pa. 52-page catalog No. 17 shows eleven basic types of R-S butterfly valves.

49 MIXING VALVE—Sarco Co, Empire State Bldg, New York 1, N. Y. 2-page bulletin No. 900 describes a new steam and water mixer to provide hot water at isolated points.

50 FLEXIBLE TUBING—Titeflex, Inc, 500 Frelinghuysen Ave, Newark 5, N. J. 6-page folder discusses physical properties and corrosion-resisting characteristics of monel flexible tubing.

51 VALVE LINE—Black, Sivalls & Bryson, Inc, Oklahoma City, Okla. 4-page booklet presents BS&B valves for salt water disposal service. Table gives valve specifications.

52 STEAM TRAPS—W H Nicholson & Co, 12 Oregon St, Wilkes-Barre, Pa. 12-page bulletin No. 1047 features steam traps equipped with bellows of bronze, monel or stainless, and bodies in bronze, cast iron and cast steel construction in sizes ¼ to 2 in., for all pressures from vacuum to 300 psi.

PRIME MOVERS AND ACCESSORIES

53 SURFACE CONDENSER—Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 32-page bulletin No. 19B6784, entitled "Let's Watch A Condenser Being Built," portrays steps in manufacture of an Allis-Chalmers surface condenser.

54 DUAL-FUEL ATTACHMENT FOR DIESEL—Caterpillar Tractor Co, Peoria, Ill. 4-page pamphlet No. 10745 underscores the versatility of the Caterpillar D13000 diesel engine when the dual-fuel attachment is added and points up the economic operation of the entire unit when utilizing natural gas.

55 STANDBY POWER—Publicity Dept, D W Onan & Sons Inc, 43 Royalston Ave N, Minneapolis 5, Minn. Folder, entitled "Onan Standby Everywhere," describes how standby electric power provides protection from electric power-line breakdowns by installation of Onan emergency electric plants.

WATER TREATMENT

56 WATER SOFTENERS AND CONDITIONERS—Elgin Softener Corp, 130 N Grove Ave, Elgin, Ill. 20-page bulletin No. 607 presents benefits and economies of soft water. This bulletin also describes all types of filters, purifiers, aerators, chemical feed systems, etc.

57 WATER PURIFIER—Cochrane Corp, 17th St & Allegheny Ave, Philadelphia 32, Pa. 12-page publication No. 4425 describes the Rapid Reactor, a water purifier that combines the basic elements for mixing, floc formation, settling, and thickening in a single reaction vessel.

58 WATER DE-OILER—Lawson Products Corp, 39 Broadway, New York 6, N. Y. 6-page folder discusses de-oiling apparatus for removing oil and oil emulsions from water.

59 CHEMICAL FEEDERS—Dept P, Liquid Conditioning Corp, 114 E Price St, Linden, N. J. 12-page bulletin No. 14 explains purposes and applications of different control systems for feeding chemicals to raw water to correct or eliminate impurities.

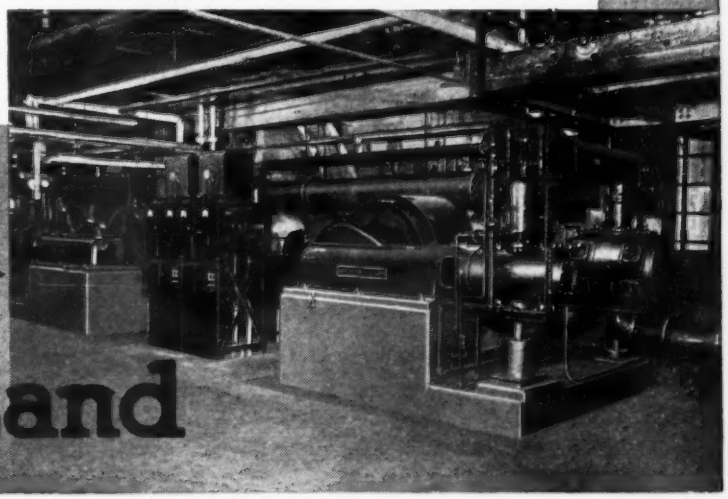
60 CHEMICAL FEEDWATER TREATMENT—Proportioneers, Inc, 9 Codding St, Providence 1, R. I. 16-page booklet, Standard Method No. 122, gives methods of applying chemicals in treatment of water for boilers. 4-page bulletin No. CAT describes various booklets on chemical proportioning and provides a post card for ordering these booklets.

SOOT BLOWING *with* air power

Soot Blowing with *Compressed Air,* particularly automatic blowing, assures systematic operation... thorough cleaning due to air density . . . reduces boiler-tube corrosion and blower maintenance... reduces stack-discharge nuisance... saves feed-water make-up . . . saves fuel . . . saves labor . . . eliminates steam-pipe insulation to blowers. No matter whether for central station, industrial-power, heating, or marine service, your boiler tubes deserve not only the *best* "dusting" you can give them, but also the *most economical.* The answer in your case may be *Air Power.*

Soot Blowing Compressors generally operate at higher pressures than standard and should be engineered to your particular installation. For the most-economical soot-blowing operation Ingersoll-Rand can furnish the correct type.

The I-R trademark on a compressor stands for 75 years of pioneering and development in the compressed-air industry, and for compressors that are dependable, efficient, durable and easy to maintain. It's your assurance of a compressor that is properly built and correctly applied for satisfactory long-life service. Let us help in your planning.

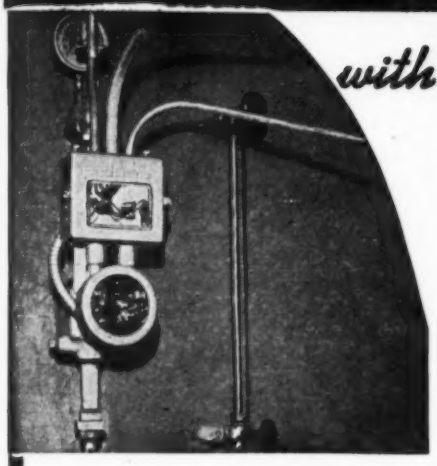


Two 300-hp Type XRE Compressors in an Eastern Central Power Station.

Ingersoll-Rand

79-1 11 BROADWAY, NEW YORK 4, N. Y.

No Waterlogging or Air Binding
in HYDRO-PNEUMATIC TANKS EQUIPPED



with **DUOTROL**

The DUOTROL maintains high water level at a fixed point and correctly balances air pressure after each pumping operation. It provides a maximum volume of water with a minimum of pump operation, saving power and reducing wear. Easy to install, stable adjustments.

The DUOTROL shown is on a tank where water at 50°F is pumped from a 600 ft. well for summer cooling of a complete shopping center. The pressure range is from 30 to 70 lbs. Ask for Bulletin D-6.

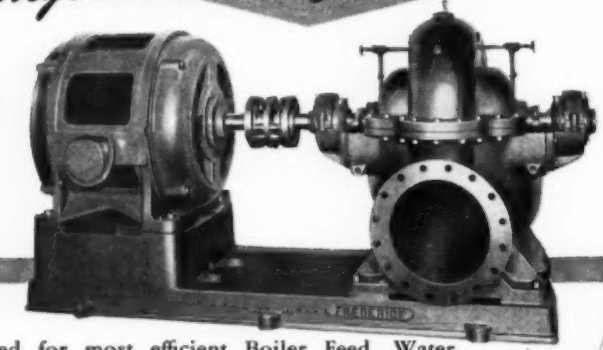
"AUTOMATIC" also makes pressure and float operated pump controls: multi-circuit sequence type, multi-circuit program type, float switches, automatic alternators, and many special controls built to specifications.

AUTOMATIC CONTROL Company
1009 UNIVERSITY AVE., ST. PAUL 4, MINN.

AUTOMATIC CONTROL
are used by all leading pump manufacturers. When ordering new pumps, specify controls by AUTOMATIC CONTROL CO.

FREDERICK CENTRIFUGAL PUMPS

Engineered to fit your job!



Designed for most efficient Boiler Feed, Water Works, Circulation, Drainage or General Service . . . Capacities up to 20,000 G.P.M. . . . Heads up to 600 P.S.I. . . . Open, Splash proof or totally enclosed ball bearing motors and steam turbine drive . . . In constant use today by many leading power plants.

Frederick
ESTABLISHED 1890
IRON AND STEEL, INC.
Pump Division — Frederick 4, Md.

—Send for these attractive, colorful booklets which give details of construction and operation of Frederick Pumps. They'll show you how Frederick Pumps are engineered to fit your job. Ask for Bulletins 103 & 104.

ALSO MANUFACTURERS OF FRECUT AND FREFORM METALWORKING MACHINERY, FREDERICK STOKERS AND ASH CONVEYORS AND A COMPLETE LINE OF GRAY IRON CASTINGS.

WELDING

61 WELDED DESIGN — Lincoln Electric Co, 12818 Coit Rd, Cleveland 1, O. 6-page folder, entitled "Designer's Guide for Welded Construction," contains a condensed summary of all the welding symbols to guide designers.

62 WELD REPAIR—Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y. 4-page bulletin explains simplified welding technique for maintenance and repair of a wide variety of metals, forms, castings, shapes and heavy machinery components.

63 CONSERVATION WELDING—American Manganese Steel Div, American Brake Shoe Co, Chicago Heights, Ill. 28-page bulletin No. 1047-W explains how to keep equipment of all types operating and producing through Amsco conservation welding.

64 BRONZE ELECTRODES — Ampco Metal, Inc, Milwaukee 4, Wis. 24-page bulletin No. W-17, entitled "Welding with Ampco Bronze Electrodes," covers line of bronze welding electrodes engineered and produced by Ampco.

65 RESISTANCE WELDING ALLOYS—Acme Electric Welder Co, 2618 Fruitland Rd, Los Angeles 11, Calif. Catalog No. 502 depicts a complete new line of alloys made from Acmeloy, Superloy and Stainaloy. New items include a variety of special goose-neck tips, offset tip holders and seam welder disks, also a complete line of standard tips and holders.

OTHER EQUIPMENT

66 DUAL-CONTROL SYSTEM — Clark Bros Co, Olean, N. Y. 8-page booklet, entitled "Dual Control System Synchronizes Compressor Speed-Intake Gas Pressure," by J M Sappington, describes how this was accomplished in Absorption Plant Inc, at Winnie, Texas.

67 ASBESTOS TEXTILES—Johns-Manville Corp, 22 E 40th St, New York 16, N. Y. 16-page brochure, entitled "Johns-Manville Asbestos Textiles," contains 26 photos that show asbestos mining operations, carding and spinning machines and various Johns-Manville asbestos textile products, including reproductions of ten popular styles of asbestos cloth.

68 INSULATION TESTERS—James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa. 12-page bulletin No. 21-45-24 covers all phases of hand-operated Meg type of Megger insulation testers. This bulletin discusses selection of instruments, applications, operating characteristics, prices and specifications.

69 INSTRUMENT TESTER—Herman H Sticht Co, 27 Park Pl, New York 7, N. Y. 4-page bulletin No. 441 describes a new Megohmer insulation tester, the Model B-6 "4 in 1" Megohmer. This instrument is called a "4 in 1" Megohmer because it combines four instruments in one: insulation tester, ohmmeter, ac voltmeter and dc voltmeter.

70 PRECISION TACHOMETER—Metron Instrument Co, 432 Lincoln St, Denver 9, Colo. Bulletin No. 101 presents the Metron tachometer for close speed measurements in laboratory, test stand and research. This bulletin describes features, ranges and prices. It also shows range extending adapters.

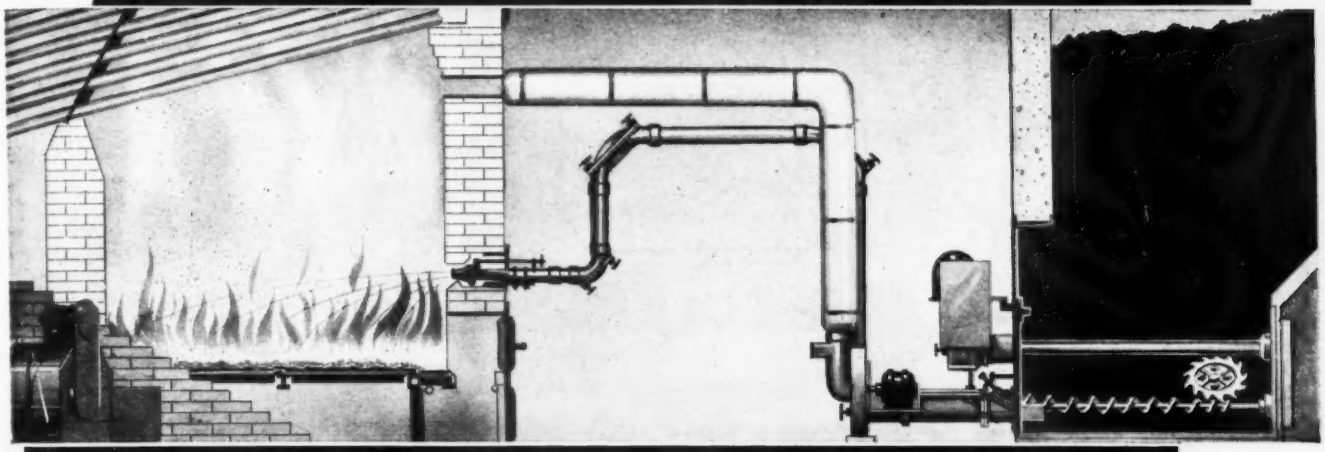
71 RECORDING THERMOMETERS — Weksler Thermometer Corp, 52 W Houston St, New York 12, N. Y. Bulletin No. 27a discusses the new Weksler 8 in. recording thermometer for recording of temperature, pressure or time of operation.

72 VERTICAL TURBINE FIRE PUMPS —Peerless Pump Div, Food Machinery Corp, 301 West Ave 26, Los Angeles 31, Calif. 8-page bulletin No. B-152 describes important features of vertical turbine fire pump and its application.

73 INDUSTRIAL PUMPS—Nagle Pumps, Chicago Heights, Ill. 36-page bulletin No. 4711 covers design, construction and operation of Nagle industrial pumps. Sizes, dimensions and weights are included.

74 PLANT SAFETY—Allegheny Ludlum Steel Corp, Pittsburgh 22, Pa. 20-page booklet gives reasons for accidents in plants and shows how they can be avoided.

IRON FIREMAN PNEUMATIC SPREADER STOKER



Extracts maximum heat from all grades of coal

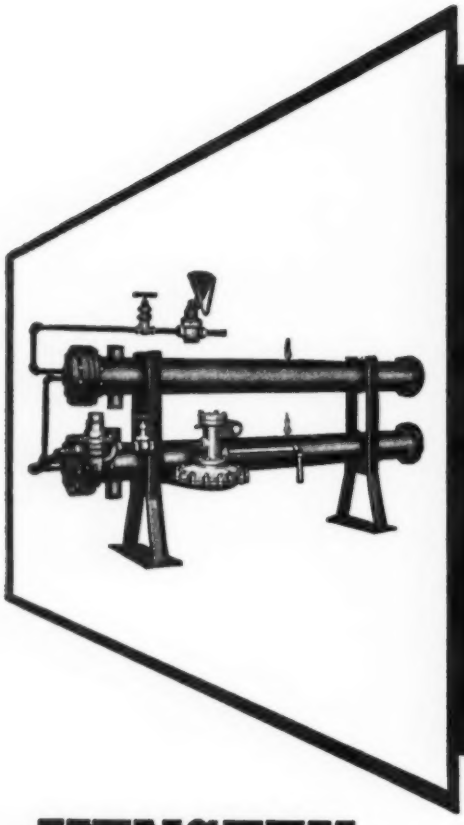
*H*ere is a stoker with real *fuel flexibility!* . . a unit engineered to get maximum heat value from a wide range of coals, including the lower cost, economy grades. By its efficient firing of these lower grade economical coals—small size steam coals, sub-bituminous and lignite—this stoker assures steam producers two big advantages: (1) low cost steam; (2) a broad, dependable range of fuel supply. This flexibility partially explains why, every year, more and more steam plant owners are converting to Iron Fireman Pneumatic Spreader stokers. They are *more than stokers.* They constitute *complete firing systems,* embodying bunker pick-up, drying, conveying and highly efficient burning of coal.

The pneumatic conveying system simplifies installation of the bunker-feed model, regardless of relative positions of coal bunker and boiler. Conveyor nozzle can enter boiler from front, side or rear. Boiler and bunker do not have to be in the same room or even on the same floor level. No costly boiler-room alterations are necessary. Hopper models also available.

For further information, write to Iron Fireman Manufacturing Company, 3220 West 106th St., Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Canada. Dealers everywhere.

IRON FIREMAN
AUTOMATIC FIRING

THE IRON FIREMAN



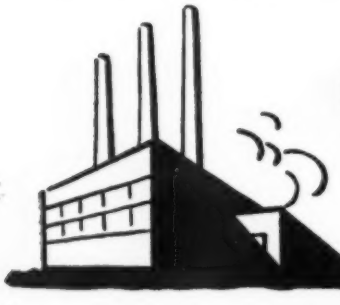
INSTALLATIONS IN:

- Electric Plants
- Oil Refineries
- Schools, Institutions
- Milk Condenseries
- Dairy Plants
- Chemical Companies
- Steel Industries
- Paper Mills
- Textile Plants
- Rubber Processors
- Canning Companies
- Cereal Processors
- Breweries

HENSZEY *Continuous Blowdown*

Look at the wide variety of industries that take advantage of the low cost power and clean steam that a Henszey Continuous Blowdown System can provide. That partial list is a typical cross section of American industry. Which means that you, too, should consider a Henszey system in conjunction with your present or planned boilers.

The Henszey system keeps boiler water concentration within safe margins — preventing foaming, priming, carryover, and the formation of sludge and scale (with proper chemical treatment). All this is accomplished continuously, automatically, and WITHOUT the heat loss of ordinary blowdown.



Contact your nearest Henszey representative or write to

HENSZEY COMPANY

Department D5 Watertown, Wis.

HENSZEY

CONTINUOUS BLOWDOWN *and* BOILER PLANT SPECIALTIES

Boiler Feed Regulators • Distillation Systems • Heat Exchangers
Feed Water Meters • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PREHEATERS

M Crater becomes transportation manager, each responsible for central district sales activities in his respective field. Dr John A Hutcheson has been appointed director of Westinghouse research laboratories, succeeding Dr L Warrington Chubb. Dr Chubb, who is retiring from active direction of the laboratories for reasons of health, has been named director emeritus and will serve in an advisory capacity.

Stephens-Adamson Mfg Co has moved its Pittsburgh offices to 237 4th Ave.

Monsanto Chemical Co has announced retirement of Samuel W Allender, assistant to president of the company since 1930. Allender will become a consultant on office management and business administration, with Monsanto as one of his clients. Charles W Downs succeeds him at Monsanto's general offices in St. Louis. R S Wobus has been promoted to newly created position of assistant to plant manager of John F Queeny plant in St. Louis. James H Zwemer succeeds Wobus as manager of Norfolk, Va., plant. Karl Ellingson succeeds Zwemer as assistant plant manager there. James A Wilson has been appointed production manager for Merrimac div at Everett, Mass. Russell L Miller succeeds Wilson as plant manager at Merrimac. A sales office has been established at 421 Southwest 6th Ave, Portland, Ore., to handle all Monsanto products. It will be staffed by Baxter Pearson, representing chemical and plastic sales, and W W Hayes, in charge of coating and adhesive sales.

Andrew A Priest has been named factory manager of instrument div, **Thomas A Edison, Inc,** West Orange, N. J.

R R Holmes has been made manager of building materials section, tar products div, of **Koppers Co.** In his new position, Hamilton will be particularly concerned with sales of roofing, *Plastipitch* protected metal and protective coatings. Thomas J Battle has been named assistant to Hamilton. He will be assigned to merchandising of protective coatings for industrial maintenance, which will be handled through distributors.

McDonnell & Miller, Inc, Chicago, has announced appointment of Nils Swanson as a vice-president of the corp.

Black, Sivalls & Bryson, Inc, announces reorganization and expansion of foundry equipment dept of special products div. The program began Feb 1, when C J Boettcher was assigned to job of handling quotations on special equipment and of expediting production through the plant. At the same time, C C Zircher was given the job of handling processing of orders, and keeping statistics on sales and shipments.

Incorporation of **Electric Equipment Co,** with headquarters at 200 Troup St, Rochester, N. Y., has been announced by Sidney Gilbert, president. This business is devoted to sale of new motors and control equipment to dealers and users of electric equipment. This company is a subsidiary

CHASE

IT'S PROVED! IT'S PATENTED!

CHASE
ANTIMONIAL ADMIRALTY

PROVED: through thirteen years of outstanding service in industry. Patented: the minimum set forth in Chase Patent No. 2,061,921 is .007% antimony. However, a minimum of about .015% is indicated over a wide range of applications. And Chase Antimonial Admiralty Condenser Tubes contain nominally .035% to allow for commercial variation sometimes encountered.

This gives you a very strong safeguard against dezincification.

It pays, then, to specify Chase — it's the safest way... and it costs no more. Write or phone your nearest Chase Warehouse or Sales Office for quotation and delivery.

Special stocks of
ANTIMONIAL ADMIRALTY
Condenser Tubes in Chase Warehouses
at
BALTIMORE, NEW ORLEANS
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also carried by—
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Chase

the Nation's Headquarters for
BRASS & COPPER

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SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WATERBURY (†Indicates Sales Office Only)

EXTRA SERVICE

"STANDCO"

PILLOW BLOCKS

and there's Extra Value in these rugged, well-designed "Standco" Pillow Blocks. Bore accurately broached to shaft size . . . faces precision machined. . . . . Base has slotted holes for lateral adjustment . . . and the Standco is both easy to clean and lubricate. Ask for Bulletin. Sold through Industrial Distributors.

HALLOWELL

STEEL COLLARS

"Hallowell" Solid Steel Collars, functionally proportioned throughout, are precision-machined so faces run perfectly true . . . highly polished all over . . . yet they cost less than common cast iron collars. 3" bore and smaller are made from Solid Bar Stock and fitted with the famous "Unbrako" Knurled Point Self-Locking Socket Set Screw. Available in a full range of sizes.

Write us for the name and address of your nearest "Hallowell" Industrial Distributor.

Over 45 Years in Business

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 577

Boston • Chicago • Detroit • Indianapolis
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"GUNITE" Concrete

(since 1915)

Linings for

STEEL BUNKERS •
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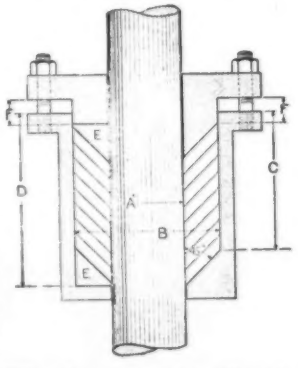
R. N. Turner, Dist. Mgr., 228 Nor. La Salle St. Chicago 1 Ill. B. H. Mueller, Distr. Mgr., 6625 Delmar Blvd., University City, (St. Louis), Mo. Philip D. Barnard, Distr. Mgr., 2036 Addison, Houston 5, Tex.

Branch Offices: New Orleans, Dallas, Denver.

Q SELF-SETTING PACKINGS

SAVE MONEY . . . . . ON *ALL* PACKING JOBS

In any packing application — whether it involves steam, air, gas, water, oil or chemicals under high or low pressure — Q-P Self-Setting Packings save money. Because of their cone-shaped design which assures a tight seal **there's little friction, packings wear longer, require less maintenance.** From the wide range of materials available you'll find a Q-P Self-Setting Packing right for your job! Send for free illustrated folder, today! **Write The Q-P Manufacturing Company, Needham Heights 94, Mass.**



EXCLUSIVE *SELF-SETTING* FEATURE!

This cross-section view shows why Q-P Self-Setting Packings give a perfect seal with minimum friction. Notice how the cone-shaped rings (A) are installed so that small end of cone faces pressure area. As pressure builds up, the lips of the packing rings (B) press snugly against plunger (C) creating the seal. Simple! Efficient!

Sales Representatives in Leading Cities from Coast to Coast

Q-P MANUFACTURING COMPANY
NEEDHAM HEIGHTS, MASSACHUSETTS

ot Norry Electric Corp in Rochester, N. Y. ABC Electric Motor Co of Rochester, N. Y., retail sales div of Norry Electric Corp, announces removal from its present location to 204 Troup St, Rochester, N. Y.

Roger W Batchelder has been appointed assistant to president of national bearing div of **American Brake Shoe Co** and William H Old has been named general purchasing agent of American Brake Shoe. Batchelder will be at national bearing div headquarters in St. Louis, Mo. Old will continue to be in New York. Frank B Newbert has been made assistant general purchasing agent of American Brake Shoe. Joseph P Kleinkort has been named general sales manager of Ramapo Ajax div. He will be at American Brake Shoe's general offices in Chicago. Fred P Biggs has been appointed first vice-president of brake shoe and castings div. In addition to his new duties, he will continue as vice-president in charge of sales of brake shoe and castings division and of the southern wheel division.

W B Coullie, vice-president and a director of **Harbison-Walker Refractories Co,** Pittsburgh, Pa., retired Mar 1.

National Electric Products Corp, Pittsburgh, has purchased the Torrance, Calif., plant of Joshua Hendy Iron Works. National Electric will equip it for manufacture of flexible electrical conduit, tubing and electrical fittings. This California plant will be operated as a branch of National Electric Ambridge factory.

Consolidating its facilities in Chicago territory, **Yale & Towne Mfg Co,** Philadelphia, announces unification of all sales and service facilities in behalf of its electric truck, hand-lift truck and dial scale divisions at Railway Exchange Bldg, 80 E Jackson Blvd, Chicago 4, under Arthur H Dobler, regional manager. S A March will continue in advisory and consulting capacities. With Dobler will be following materials-handling specialists: C M Barteleme, regional sales manager, T J Brunswick, E E Johnson, H L Marquard, Fred P Mignin, R A Rieger, W R Saunders and Roy L Wolter.

Ansul Chemical Co, Marinette, Wis., has named Kenneth B Covert sales manager of its fire extinguisher div.

Pennsylvania Transformer Co, Pittsburgh, Pa., announces appointment of Rush F Young as manager of Pittsburgh sales district. Young's offices will be at company headquarters, 808 Ridge Ave, North Side. As manager of Pittsburgh sales district, Young will be in charge of company's distribution and power sales in western Pa. A sales office has been opened at 25 Broad St, New York City, with E S Banghart as manager of New York district.

Sidney G Harris has become sales manager for **Richfield Mfg Corp,** 315 Fifth Ave, New York City.

Wagner Electric Corp announces transfer of Fred Pasher from position of manager of its Cleveland branch to that of

How faithful

are your

"faithful" old pumps

There comes a time in the life of *everything mechanical* when it is no longer profitable to keep it in operation. Time takes its toll in fatigue, wear and obsolescence.

Pumps are not exceptions

Old pumps may continue to run and give "satisfactory" service. However, tests usually show a steady decline in efficiency, a steady rise in power requirements and maintenance costs.

If your pumps are not giving the service you now expect, or your pumping requirements have increased, it is time to talk with a Warren representative. Write to us or to our nearby office.

WARREN STEAM PUMP COMPANY, INC.
Warren, Massachusetts

For continued high efficiency, low power consumption, low maintenance costs · · · replace with

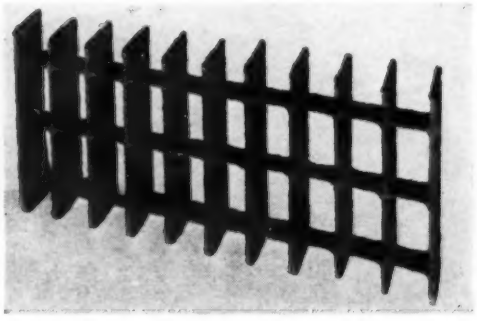
Warren Pumps

CENTRIFUGAL AND RECIPROCATING

Atlanta Boston Chicago Cleveland Denver Detroit Houston Manchester, Conn. Los Angeles Minneapolis New Orleans New York Philadelphia Pittsburgh Richmond San Francisco Seattle St. Louis

P-12

FOR TWELVE YEARS



. . . *under extreme conditions*

The section illustrated was cut from a panel of Hendrick Mitco that for twelve years was in an open yard between buildings in an industrial plant. It not only was exposed to rain, snow and atmospheric corrosion, but was in a drainage area and actually under water much of the time.

The joints show the least corrosion and have no crevices or cracks, although the side surfaces of the bars have been roughened and practically eaten away.

Write for detailed information on Hendrick Mitco Grating, Open Steel Flooring, Shur-Site Treads, and Amorgrids.

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HENDRICK

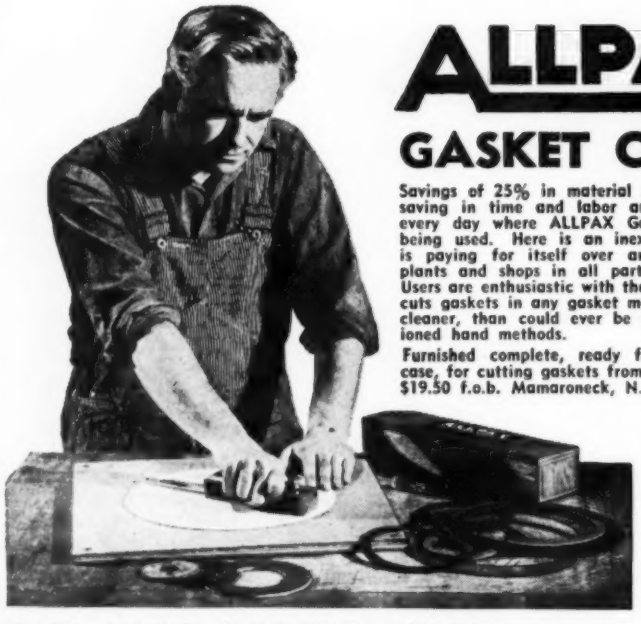
Manufacturing Company

46 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

Save Time, Material and Labor . . . . . by cutting gaskets the modern way



ALLPAX GASKET CUTTER

Savings of 25% in material and a tremendous saving in time and labor are being recorded every day where ALLPAX Gasket Cutters are being used. Here is an inexpensive tool that is paying for itself over and over again in plants and shops in all parts of the country. Users are enthusiastic with the way the ALLPAX cuts gaskets in any gasket material faster, and cleaner, than could ever be done by old-fashioned hand methods.

Furnished complete, ready for use, in metal case, for cutting gaskets from 1" to 36". Price $19.50 f.o.b. Mamaroneck, N. Y.

30-DAY FREE TRIAL OFFER

Write for details.

THE ALLPAX CO., INC., *Mamaroneck, N.Y.*

manager of Dallas branch, replacing the late B B Pierce, whose death occurred in Feb of this year. Elmer Gent replaces Pasher as manager of Cleveland branch.

Ball Associates, Inc, Buffalo, N. Y., has been appointed exclusive representatives of **Burlington Instrument Co** in following territory: state of N. Y. with exception of Long Island, Metropolitan area of New York City, and the two southeastern counties of Rockland and West Chester, replacing Allen-Ball Corp, 201 E Water St, Syracuse, N. Y., who formerly handled the accounts in this territory. Electric Sales & Engrg Co, Milwaukee, Wis., has been named to represent Burlington Instrument in state of Wis. east of and including counties of Lafayette, Iowa, Sauk, Junea, Wood, Clark; and south of and including counties of Marathon, Shawano, Brown and Door, replacing Fritz A Meyer, Milwaukee, who formerly represented the firm for this territory.

Engineering Controls, Inc, 2835 E 11th St, Los Angeles, announces appointment of Hans Bohuslav as vice-president in charge of engineering.

Frederick C Horner has retired as director of field operations section of distribution staff of **General Motors Corp.** He will be succeeded by Light B Yost.

Frank M Hawley, president of Morse Chain Co div of **Borg-Warner Corp,** and Chisholm N Macdonald, president of Formsprag Co of Ferndale, Mich., jointly announced formation of Morse-Formsprag sales dept, with headquarters at 7601 Central Ave, Detroit. This new organization binds precision manufacturing facilities of Formsprag Co and sales organization of Morse Chain Co. Morse-Formsprag has developed a completely new line of over-running clutches for industrial use.

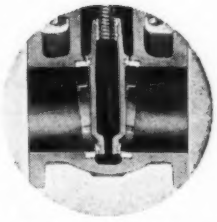
Progressive Welder Co has expanded West Coast facilities for fast service to industry in this area: Included in the new setup, which is at 1161 E Florence Ave, Los Angeles, are assembly and service facilities for Progressive's welding machines.

New address of **Rockbestos Products Corp** Chicago office and warehouse is at 1500 S Western Ave. W E Tierney is district manager.

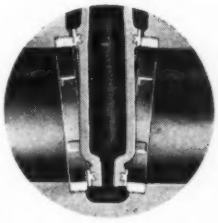
Steamaster Automatic Boiler Co, Los Angeles, has announced opening of Midwestern branch office in Chicago. New div includes general sales and administrative offices at 39 S La Salle St, Chicago, as well as warehousing facilities in the same city. Joseph Sullivan is in charge. Sullivan, whose title is general manager of the new branch, is direct representative of home office and factory, and heads sales and service departments.

Commander Edward Hart has been appointed manager of New York office of **American Engrg Co** at 75 West St.

Leslie Co, Lyndhurst, N. J., has named following agents to handle industrial sales and service: (1) Welby C Rouse, Greens-

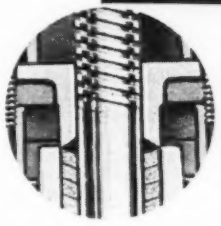


Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.

Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.



Brass Liner on Glands assures greater resistance to corrosion and scoring.

WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features

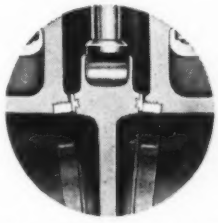
For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.

WALWORTH

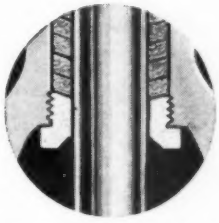
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

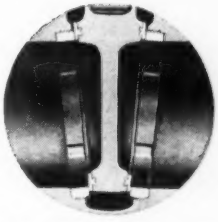
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



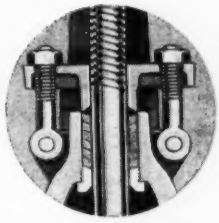
T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.



Bronze Back-Seat Bushings in bonnets of OS&Y valves.

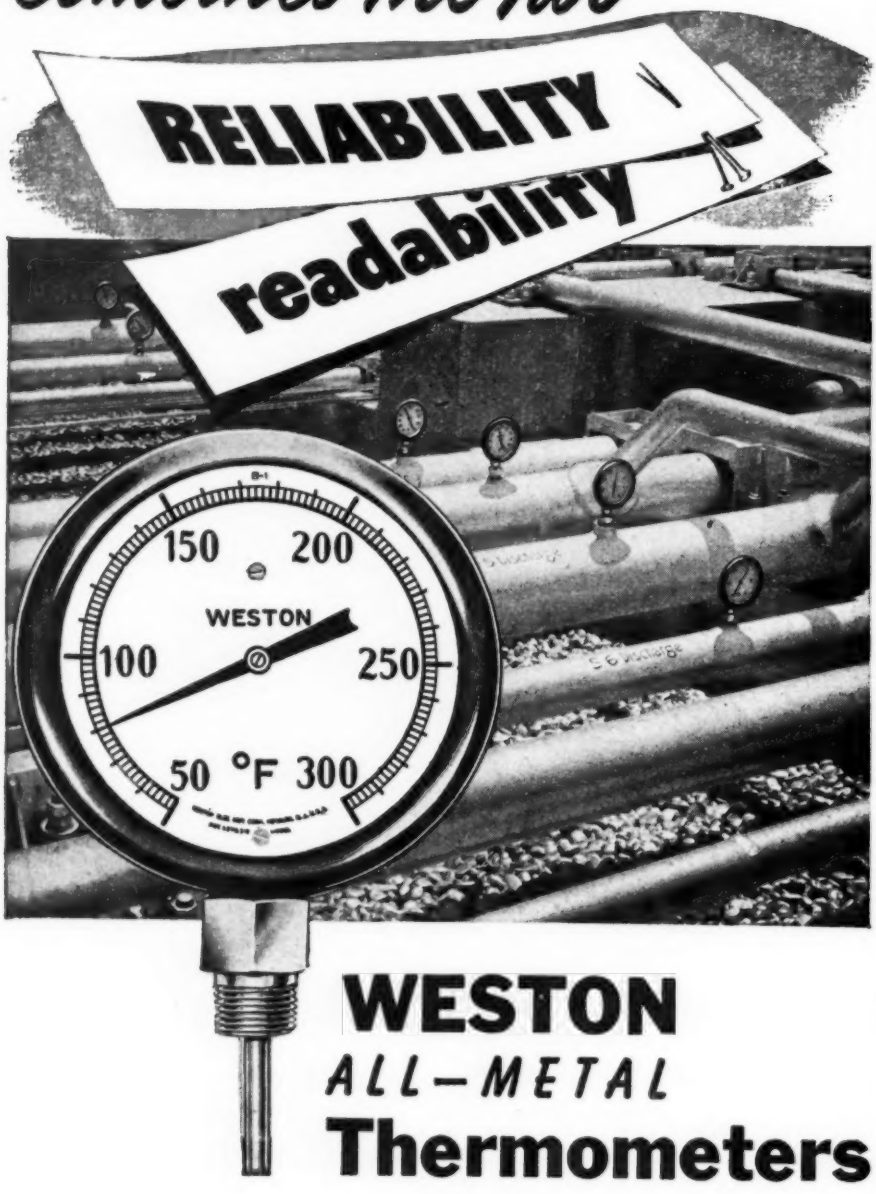


Solid Web Type Disc in OS&Y valves for greater strength and longer service.



Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

Combines the two



WESTON
ALL–METAL
Thermometers

The legible, wide open scale on the WESTON thermometer permits you to take full advantage of its inherent, long-time accuracy. Even from a distance, readings can be made "right on the nose."

WESTON thermometers are available in a variety of types, stem lengths and scale ranges for most industrial applications. If your jobber cannot supply you, see your local WESTON representative, or write for Thermometer Bulletin . . . Weston Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark 5, New Jersey.

MAX-MIN models also available to indicate highest or lowest temperature reached.

Weston *Instruments*

boro, N. C., covering state of N. C. (2) Equipment Sales Corp, Kingsport, Tenn., covering eastern Tenn. (3) Landes, Zachary and Peterson, Denver, Colo., covering Colo., Wyo., N. M., Utah and El Paso, Tex.

Appointment of Penn Central Equipment Co, Altoona, Pa., as a distributer of entire Hewitt Rubber Div's line of industrial hose, conveyor and transmission belting, and packing, has been announced by **Hewitt-Robbins Inc.**

Swan-Finch Oil Corp, Rockefeller Center, New York City, has made Nelson V Joyce vice-president in charge of purchasing and John M Parker Jr sales manager of tractor div.

Frank M Sweeny has been named sales representative in Baltimore, Md., district, with headquarters at 4136 Roland Ave, for **Iron & Steel Products, Inc,** Chicago.

Flexible Tubing Corp, organized late in 1947, has announced its entry into flexible tubing field. Laboratory, design engineering and manufacturing facilities will be centered in Branford, Conn. Frederick K Daggett is president and treasurer. Joseph B Morse is secretary and Alexander K Murphy assistant treasurer. Board of directors consists of following business executives and professional men: A G Newton, Joseph W Powell Jr, and Dr Arthur Bliss Dayton, William G Falsey, Bruce Payne, Calvin D Mac Cracken, Frederick K Daggett.

New quarters have been provided for Atlanta district sales office of **Cutler-Hammer, Inc,** Milwaukee, Wis. New location is at 714 Spring St, N. W. G E Hunt is Atlanta district sales manager.

Idaho Power Co, Boise, has elected T E Roach president, succeeding C J Strike who died Feb 11.

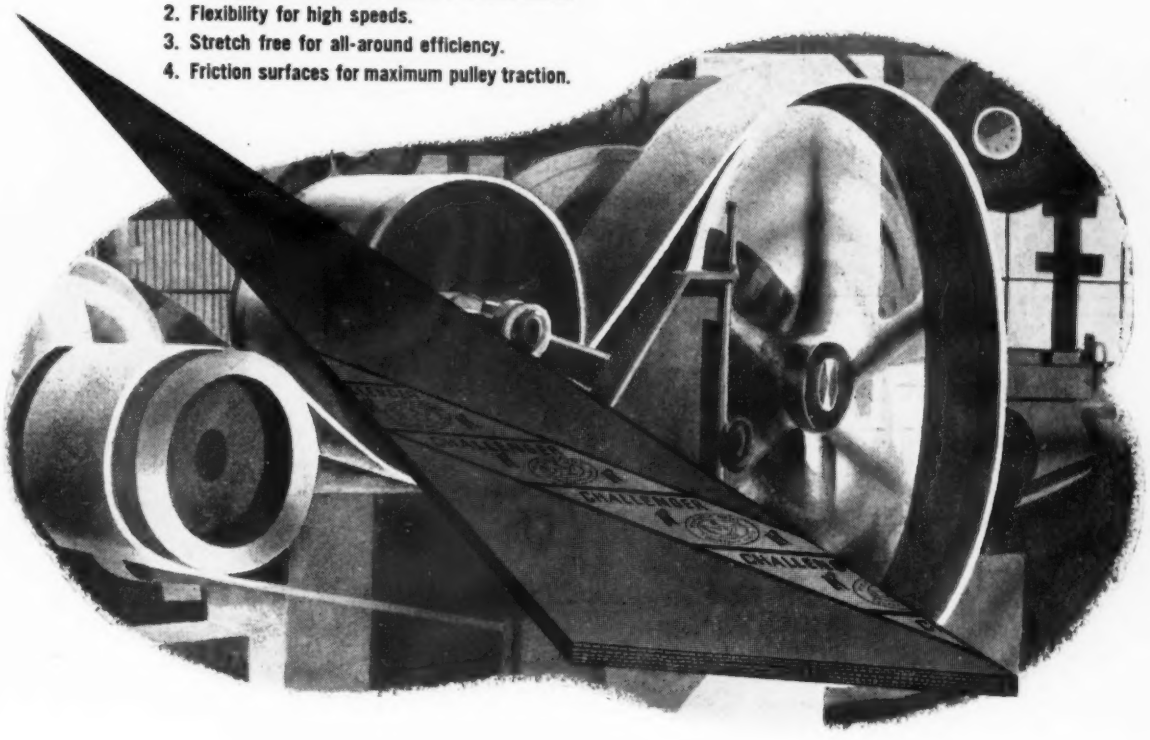
Appointment of R E Hodges, of Ashland, Ky., as Charleston, W. Va., div manager of **Appalachian Electric Power Co,** has been announced. He succeeds W F Ficklen who is being relieved of his detail duties as div manager but who will continue as vice-president and director.

West Penn Power Co has promoted six employes to new positions: (1) J K Walter has been made training supervisor, with responsibility of coordinating training activities in all departments. He reports to P A Rice, personnel manager. (2) Charles F Anderson has been named staff assistant in power generating dept, reporting to J E Thomas, general superintendent of power, at Pittsburgh. Anderson will supervise training activities in that dept, and will also have other specially assigned duties relating to personnel and organization matters affecting all generating stations. (3) Earl J DeChambeau has been promoted to supervisor of training for operating dept, reporting to J O Chambers, commercial manager at Pittsburgh. He will coordinate training activities within operating dept. (4) Thomas B Giles was made assistant manager of Con-

A Distributor serves you Best

CHALLENGER TRANSMISSION BELTING

1. Strength for heavy, sustained or shock loads.
2. Flexibility for high speeds.
3. Stretch free for all-around efficiency.
4. Friction surfaces for maximum pulley traction.



Invite the Distributor Salesman into your Warehouse

25th Anniversary

1948 marks the 25th Anniversary of Republic Rubber Division's 5-Point Sales Policy. This policy, by intent, provides service to industry through carefully chosen distributors rather than branches, because, Republic believes it's a more economical and efficient way of doing business.

If you invite a distributor's salesman to look at the items in your warehouse, the chances are he will show you where his firm is carrying in stock many maintenance items that you have in inventory. Thus, by using the distributor's stock you can reduce your inventory investment. But best of all, he gives you personal service, and often special delivery; he responds quickly to your emergency needs, and he is an impartial consultant regarding product quality. Take Mr. Distributor Salesman into your warehouse, it will be well worth your while.

Republic Rubber Distributors can do as much *or more* for you, on an average, than Republic can do direct.

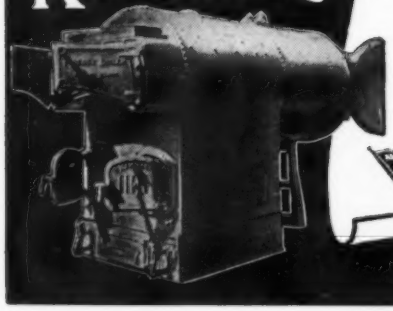
MECHANICAL RUBBER GOODS BY

REPUBLIC RUBBER DIVISION

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION . . . YOUNGSTOWN, OHIO
Lee DeLuxe Tires & Tubes, Conshohocken, Pa.

Extra STRENGTH for Heavy Duty

KEWANEE



● Backed by more than 75 years of boiler building experience Kewanee Heavy Duty types have all the characteristics which make firebox boilers ideal for high pressure.

10 to 304 H.P.

100, 125, 150 lbs. W. P.

Built of steel with extra stout stays and braces to add further strength.

For 6" Scale with pipe diameter markings . . . WRITE Dept. 96-K5

KEWANEE BOILER CORPORATION

KEWANEE, ILLINOIS

Division of AMERICAN RADIATOR & Standard Sanitary

SPECIAL SECTION POSTPONED

Because of unsettled conditions in the printing industry, the special section on electrical protective devices for low-voltage circuits, originally scheduled for the June issue of POWER, has been postponed to July. Watch for it.

GENERAL INDUSTRY · CHEMICAL & PROCESSING · OIL FIELDS · MINING · POWER PLANTS

Wherever piping dependability is a MUST...

CATAWISSA VALVES ARE THE ENGINEER'S PREFERRED CHOICE FOR TROUBLE-FREE SERVICE, MINIMUM MAINTENANCE COSTS!

LOOK AT THE ECONOMY HERE!

Eliminate the usual additional union and nipple on either outlet or inlet end of the line!

Double Extra Heavy Hot Forged Steel SWING CHECK VALVES

Pipe union type, especially adapted for high temperatures, extreme high pressure service, corrosive and acid conditions. Designed for perfect freedom of movement, with 100% opening. Stainless steel flapper and assembly, forged steel integral seat.

Recommended for . . .
600-lbs. Working Steam Pressure
1500-lbs. Oil, Water or Gas
Tested to 4000-lbs. NSHP

write for your copy of Bulletin 10-A

CATAWISSA VALVE & FITTINGS CO.
206 Mill St. • CATAWISSA, PA.

HOT FORGED STEEL · STAINLESS STEEL
UNIONS

nellsville district, reporting to Manager S M Pyle. (5) James F Wolfe will continue as assistant district manager at Connellsville and, together with Giles, will assume responsibilities for conducting operating dept training school. (6) Richard A Brinker replaces Giles as line foreman at Greensburg.

Charles A Rice, of Greenville, has been elected to succeed James W Wolfe as a member of **South Carolina Public Service Commission.**

David A Aitken has been appointed director of development activities of **Cleveland Electric Illuminating Co.** Aitken succeeds Robert C Hienton, who was promoted to position of industrial sales manager.

J E Sirrine Co, engineering firm of Greenville, S. C., has elected A S Bedell chairman of executive committee. Henry L Hagerman has been named vice-chairman.

M W Crew announces formation of **Crew Engrg Corp,** 633 N Water St. Milwaukee, Wis., for mechanical design and product development.

Columbia University has appointed Dr Charles F Bonilla professor of chemical engineering at school of engineering.

Dr John T Rettaliata, director of dept of mechanical engineering at **Illinois Institute of Technology,** will become dean of engineering next Sept 1. Dr. Rettaliata will fill the position vacated by James C Peebles. Alex D Bailey, vice-president and chief operating engineer of Commonwealth Edison Co, has been named chairman of heating plant and services div of Illinois Institute of Technology's $15,000,000 development program. John T Beatty, president of United Specialties Co, has been appointed chairman of mechanical engineering div of special development program campaign.

Refrigeration Equipment Manufacturers Assn has elected George E Mills, of Cleveland, Ohio, as public relations director.

National Electronics Conference, Inc, has selected W C White, of General Electric Co, Schenectady, N. Y., as chairman of board of directors for the current year. Other officers that have been elected are as follows: E O Neubauer, president; G H Fett, executive vice-president; R R Buss, secretary; O D Westerberg, treasurer; Karl Kramer, vice-president in charge of arrangements; H A Leedy, vice-president in charge of program; L G Killian, vice-president in charge of publicity; A H Wing, vice-president in charge of publication; J A M Lyon, chairman of exhibits committee; R K Metcalf, chairman of hotels committee.

Howard E Sill, vice-president of Muncie Gear Works, Inc, Muncie, Ind., has been elected secretary-treasurer of **Stoker Manufacturers Assn.** Sill succeeds F H Herndon, of Link-Belt Co, Chicago, as

ANKORITE
TRIPLE "U" PACKING

IDEAL FOR RAMS AND PLUNGERS OF ALL TYPES OF HYDRAULIC MACHINES!

Ankorite Triple "U" Packing is ideal for use on high or low pressure hydraulic apparatus working either with oil or water, and may be substituted for the conventional "U" leather hydraulic packings. Its unique construction assures low friction.

Ankorite Triple "U" Packing can be ordered in prefabricated rings or carried in stock in various sizes in continuous lengths from which rings can be cut to suit any diameter rod, plunger or ram.

Let Ankorite Triple "U" Packing solve your difficult hydraulic problems. Write today for full details.

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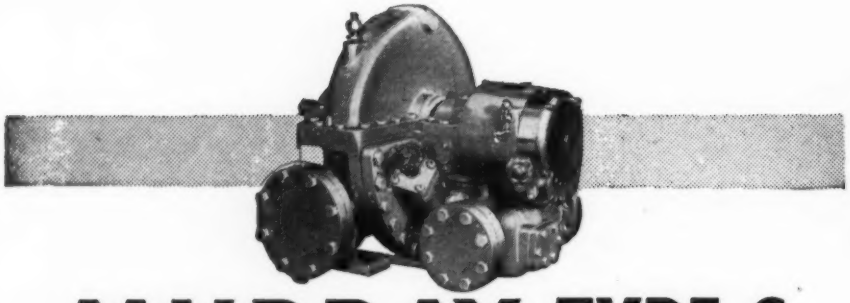
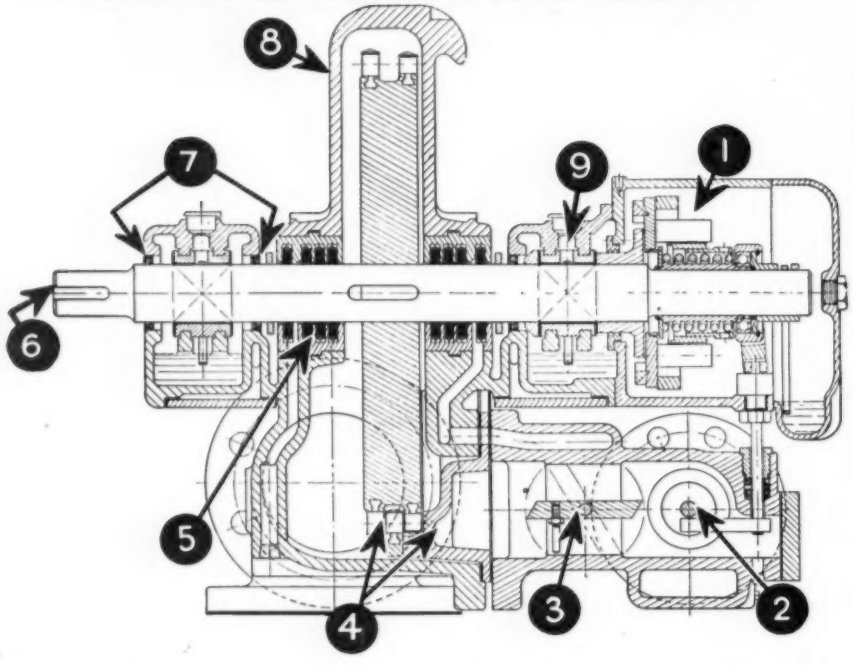
THE ANCHOR PACKING CO.



MURRAY *TYPE-S*

SINGLE STAGE TURBINES FOR MECHANICAL DRIVE



1. Mechanical constant speed governor completely enclosed and fully lubricated. Heavy cast housing, removable for inspection. Provision for tachometer reading, by removing end plug.
2. Double seated balanced stainless steel governor valve, with stainless steel renewable seats. Corrosion resisting steam strainer ahead of control valves.
3. Separate emergency overspeed butterfly trip valve actuated by unbalanced weight type emergency overspeed governor.
4. Stainless steel blading and shroud band. Nozzles drilled and reamed in replaceable nozzle ring.
5. Carbon ring glands, stainless steel springs, corrosion resisting gland cases. Cast in leakoff reduces pipe fittings necessary.
6. Tapped hole in shaft end facilitates drawing on coupling.
7. Bearing seals effectively retain oil and exclude dirt and moisture.
8. Casing split at centerline allowing inspection without disturbing alignment or steam connections.
9. Sleeve type babbitt lined bearings with split oil rings, easily removable. Babbitt thrust faces against collars. Inspection covers and flush level glasses included. Water cooling always furnished.

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Bulletin T-121 gives complete details. Write for your copy today.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

secretary-treasurer. Herndon resigned from this position because his company disposed of its stoker div recently to Timken-Detroit Axle Co. C P Meredith has been appointed a member of the association's board of directors to fill the vacancy on board created by resignation of Herndon.

Propeller Fan Manufacturers' Assn has elected following officers for 1948: Lyman C Reed, president; W J Lohman Jr, vice-president; L O Monroe, secretary-treasurer.

National Association of Fan Manufacturers has appointed following officers for 1948: R A Wasson, president; T J Flanagan, vice-president; and L O Monroe, secretary-treasurer.

Gustave Watters, executive vice-president of Niagara Falls Power Co, has been named to board of sponsors of **Western New York Safety Conference.**

Harry Woolhouse has been appointed maintenance engineer at **Troy Hospital,** Troy, N. Y.

OBITUARIES

Benedict Gifford, 58, president of Gifford-Wood Co, Hudson, N. Y., died suddenly on Mar 22 at Hotel 10 Park Ave, New York City, of a heart attack.

Charles M Everett, 59, chief engineer at Connecticut State Hospital, Middletown, Conn., since 1942, died in Middlesex Hospital on Mar 17.

Gunnar Emil Carlson, 46, operating engineer at Narragansett Hotel, Providence, R. I., died on Mar 13.

Duncan Winston Harmon, of Richmond, Va., a foreman for Virginia Electric & Power Co for 25 years prior to his retirement several years ago, died Mar 11.

Curtiss C Gardiner, 73, chairman of board of Hartford Steam Boiler Inspection & Insurance Co, died at Hartford, Conn., on Feb 23.

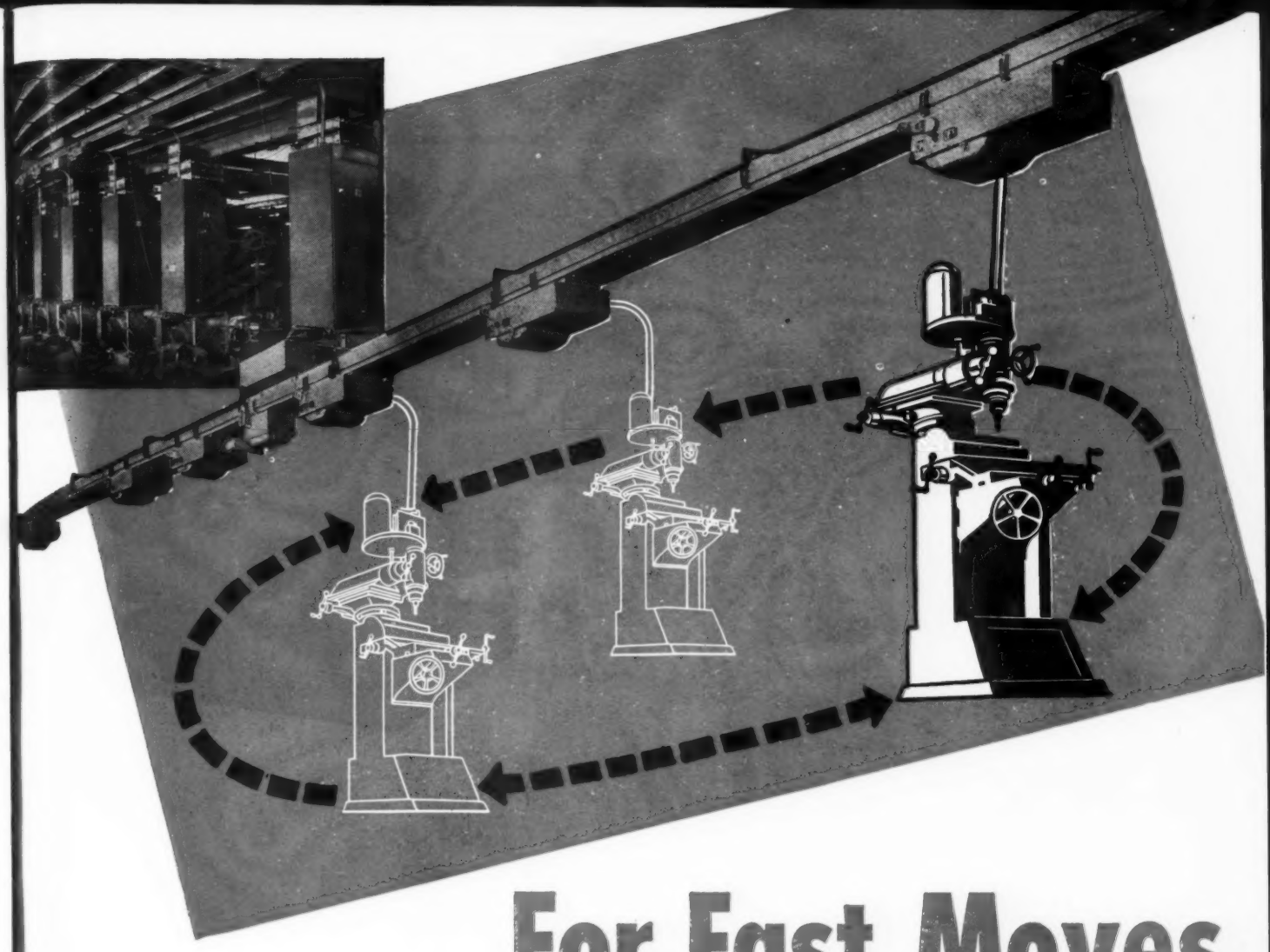
Benjamin F Lee, 76, pioneer in development of electrical power in Niagara frontier, died Mar 5 at Eagle Rock, Calif., after an illness of three months. Lee was manager of electrical dept at Niagara Falls Power Co when he retired in 1939 and moved to Calif.

David A Russell, 60, engineer at Children's Hospital, Buffalo, died recently after a brief illness.

C J Strike, president of Idaho Power Co, Boise, died Feb 11.

Richard Lyons Jacobs, 77, for many years general manager of Idaho Power Co in Payette, died Feb 19.

Herbert L Rawlins, 47, manager of protective devices engineering in switchgear and control div of Westinghouse Electric Corp, E Pittsburgh, Pa., died on Feb. 17.



For Fast Moves

Relocate machines with no delays for rewiring

Power can be taken off wherever needed with this convenient, flexible and economical distribution system.

Power where you want it — with Trumbull FLEX-A-POWER Plug-In Busways—gives you maximum flexibility in machine arrangement without the cost and nuisance of rewiring each time you change the layout.

With FLEX-A-POWER Plug-In Busways covering your whole plant, you can move a machine or a whole line of machines with no interruption of power. Convenient outlets every 12 inches permit plug-ins *right at the load.*

Even when major changeovers require moving an entire department, the FLEX-A-POWER system can be moved along, too — dismantled, removed and reinstalled quickly, with practically 100% use of all materials.

That's because every part of a Trumbull Busway System is prefabricated, which of course reduces original installation and construction costs. FLEX-A-POWER is stocked in standard 10 foot lengths and is available in capacities from 250 to 1000 amp. with all necessary fittings and accessories.

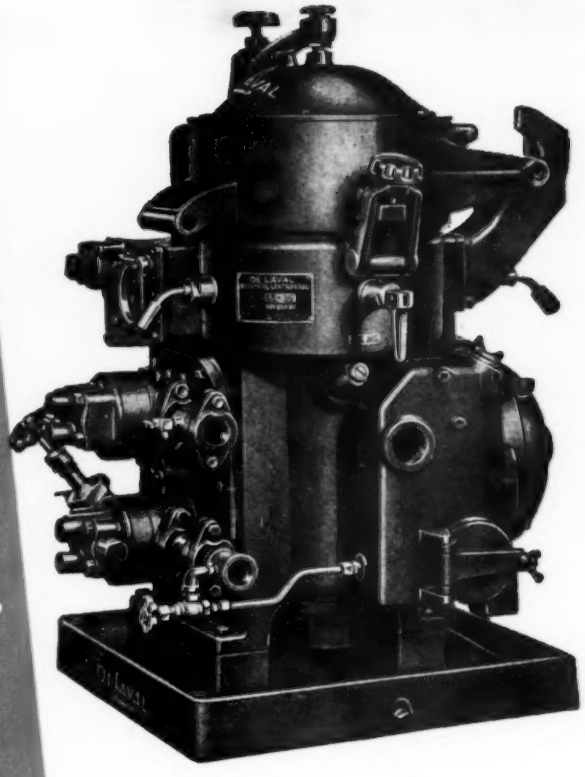
Send for Bulletin. THE TRUMBULL ELECTRIC MANUFACTURING CO., Plainville, Conn. Other factories at Norwood, Ohio • San Francisco • Seattle • N. Hollywood. Sales offices and representatives in all important cities.

The OVERHEAD that pays for itself in Cost Reduction

TRUMBULL (T) ELECTRIC

Flex-a-Power

CENTRIFUGE NEW TURBINE OIL and PREVENT DAMAGE by Picked-up IMPURITIES



When turbine oil is changed, the new turbine oil has a detergent action. It picks up deposits of sludge and sediment that may have settled out from the old oil in the turbine reservoir and piping. The best way to prevent damage by this picked-up material is to remove it from the oil by centrifugal force before it can circulate through the system.

A De Laval Oil Purifier is the most foolproof way of keeping turbine lubricating oil clean. In the bowl, or purifying member, both the solid impurities and any moisture that may get into the oil are instantaneously separated out. Removed water is discharged continuously, and dirt is stored in the bowl, out of the zone where purification takes place.

Action of the De Laval machine is wholly mechanical — De Laval Purifiers do not remove the valuable inhibiting agents added by the refiners.

De Laval

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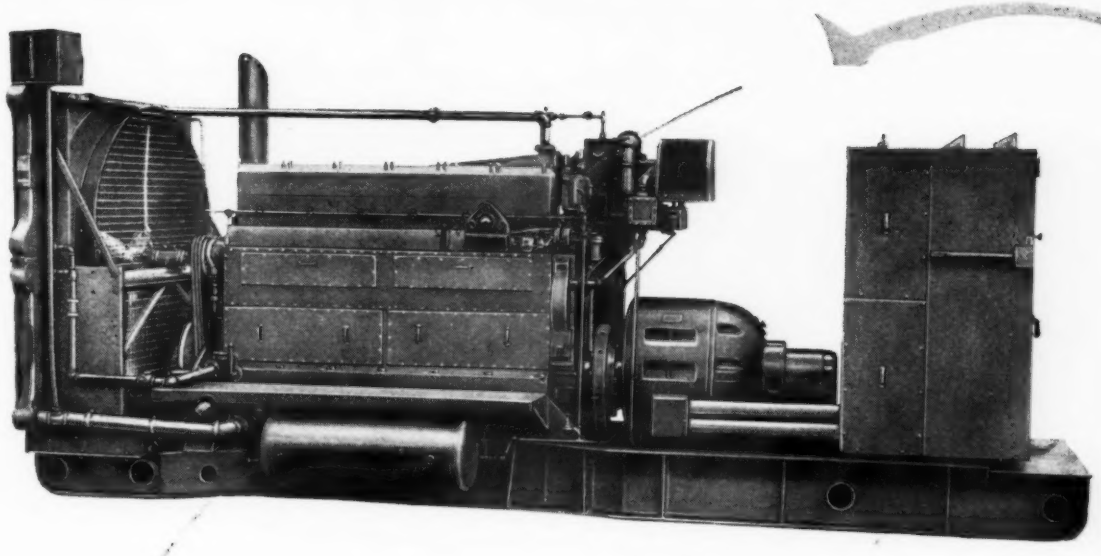
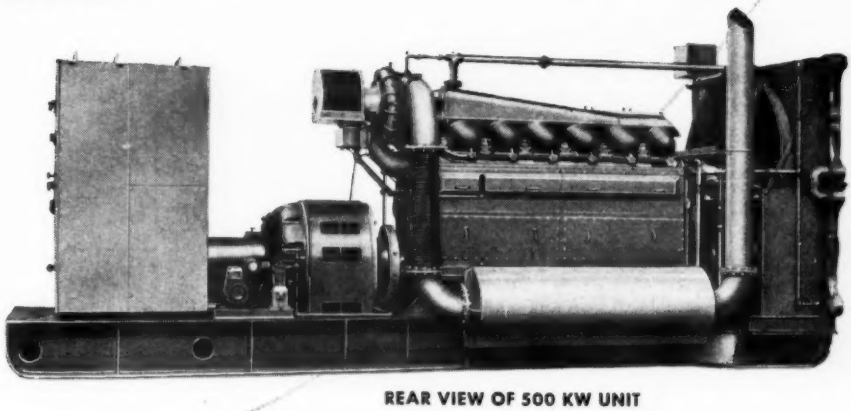
LUBRICATING OIL PURIFIERS



NEWEST of the CP Diesel-Electric Package Units



REAR VIEW OF 500 KW UNIT

EFFICIENCY PLUS ECONOMY

LOW FUEL CONSUMPTION results from efficient design of combustion chamber, valve mechanism and fuel injection system.

INSTANTANEOUS STARTING is assured by simple starting valve which admits air through distributor. The distributor, in turn, admits air at timed intervals to each cylinder.

DUST-TIGHT COVERS completely enclose all wearing parts, but are easily removed for inspection.

LUBRICATION is completeley automatic force feed, resulting in exceptionally low maintenance.

EVERY PART is designed with ample strength for maximum rigidity with minimum weight, assuring long service life.

An outstanding product of Chicago Pneumatic's 34 years' experience in engine building, this 500 kw CP Turbo-charged Diesel Engine Generator Set* is designed for continuous, medium-speed, heavy-duty service.

Furnished complete with piping, wiring, and all accessories, ready for immediate installation . . . it can be set up quickly and easily . . . in minimum space . . . with minimum installation expense.

Write for complete information.

*BUILT UNDER ELLIOTT-BUCHI LICENSE

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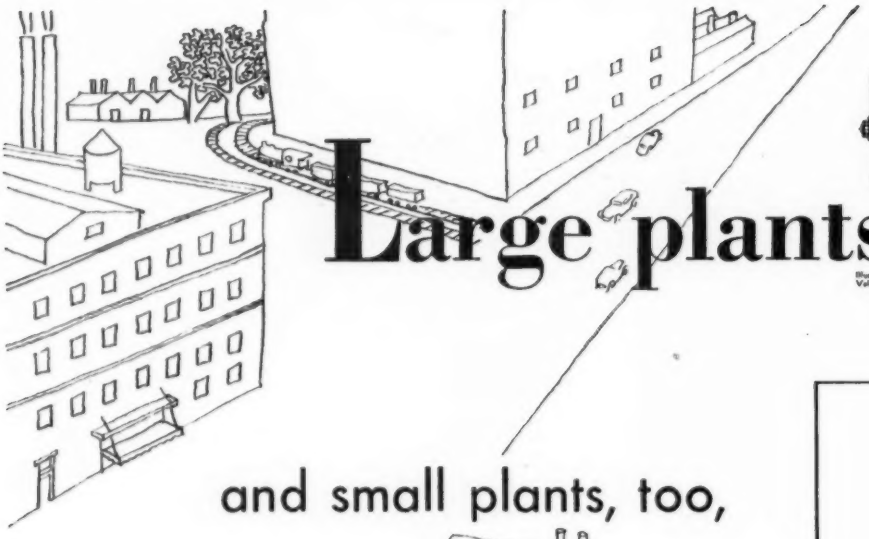
AIR COMPRESSORS • ELECTRIC TOOLS • PNEUMATIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



Large plants

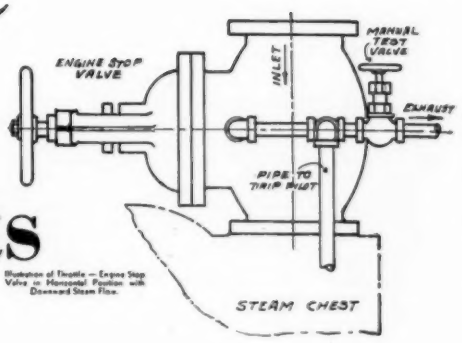
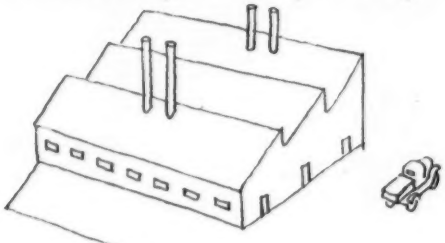
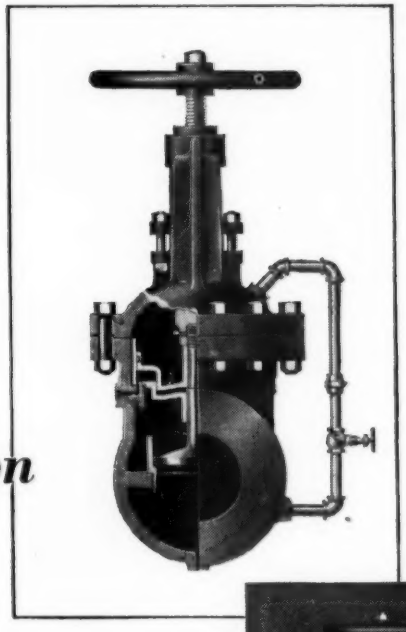


Illustration of Throttle — Engine Stop Valve in Horizontal Position with Downward Steam Flow.

and small plants, too,





need this Engineered protection

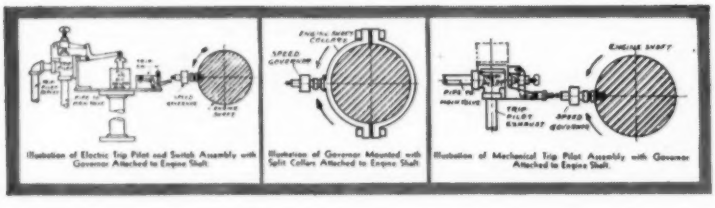
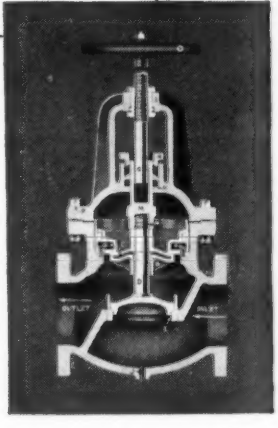


Illustration of Electric Trip Pilot and Switch Assembly with Governor Attached to Engine Shaft.

Illustration of Governor Mounted with Split Collars Attached to Engine Shaft.

Illustration of Mechanical Trip Pilot Assembly with Governor Attached to Engine Shaft.



GOLDEN-ANDERSON

Throttle

and

Automatic

engine stop

Valves

Throttle and Automatic Engine Stop Valves by Golden-Anderson have saved manufacturers many thousands of dollars in property and personnel damage from run-away engines and turbines. These valves are completely automatic, but a remote control attachment is included to permit manual operation for tests and other purposes. When handwheel stem is run up, the valve will automatically open to admit pressure into engine or turbine, thus permitting easy return to engine operation. For complete information on the more than 1500 types and sizes designed and built by Golden-Anderson, write for new catalog today.

GOLDEN-ANDERSON *Valve* **Specialty Co.,** KEENAN BUILDING, Pittsburgh 22, Pa.

Are Power Plant Coal Bills Too High?

In many cases, steam generating costs are too high because coal purchases are limited to a narrow range of costly premium coals — with little or no possibility of purchasing the best coal value available in a changing or competitive market.

Modern power plant design has advanced to the point where complete fuel flexibility is entirely possible. The cost to provide fuel flexibility in new plants, or when modernizing existing plants, is but a small part of the capital investment. Yet this small additional investment pays dividends throughout the life of the plant by providing *reliable utilization* of various coals — enabling the operator to purchase the best fuel value under all market conditions.

The Engineering Research Department of the Ohio Coal Association welcomes the opportunity to supply helpful information to power plant designers, owners, and operators on how power plants, large and small, can widen coal selection and reduce coal bills. Inquiries are invited.

THIS BOOKLET contains charts, illustrations, diagrams, and technical data on • fuel flexibility and power costs • how to conduct a fuel investigation for lower power costs • how burning equipment affects fuel performance — and other helpful information of interest to power plant designers, owners and operators. Free on request — write today.

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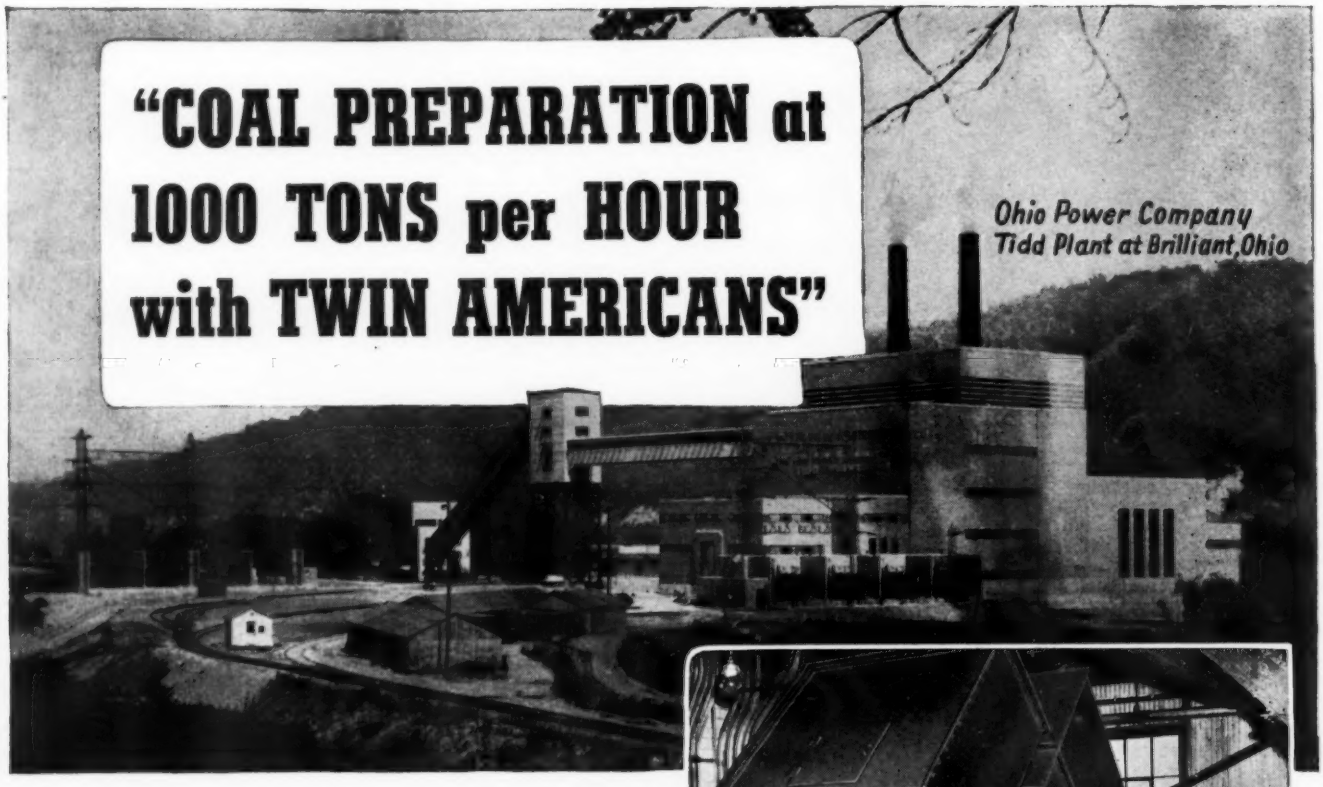
"COAL PREPARATION at 1000 TONS per HOUR with TWIN AMERICANS"



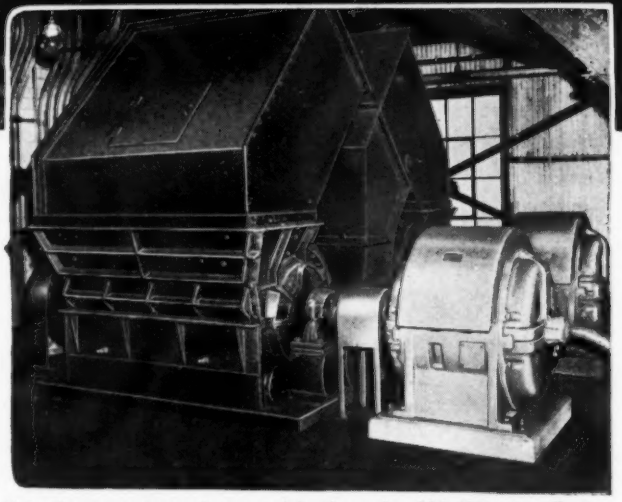
Ohio Power Company
Tidd Plant at Brilliant, Ohio

And the Complete Crushing Units Occupy only 12" x 12" x 12"

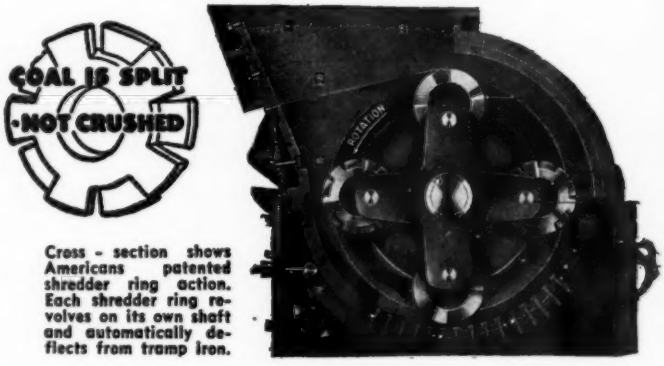
110,000 kilowatt output represents converting 1200 tons of coal per day into power . . . Continuous pulverizer feed from bunkers kept at constant level of ¾" by conveyors from the two "Type S No. 60" American Ring Crushers which reduce the 16" ROM bituminous coal.

Direct-connected with two 200 HP 720 RPM motors, the Americans employ efficient shredder ring action with an unusually conservative power demand.

The uniform product and the dependability of Americans are considered essentials to the unfailing, high output of the Ohio Power Co. and other power plants throughout the world. Americans offer a complete crushing plant in one compact unit,—no auxiliary crushers or refuse picking operations are required.



Note the compactness of area and headroom in which these two direct motor-connected Model 605 Americans are installed including by-pass between.



Cross - section shows Americans patented shredder ring action. Each shredder ring revolves on its own shaft and automatically deflects from tramp iron.

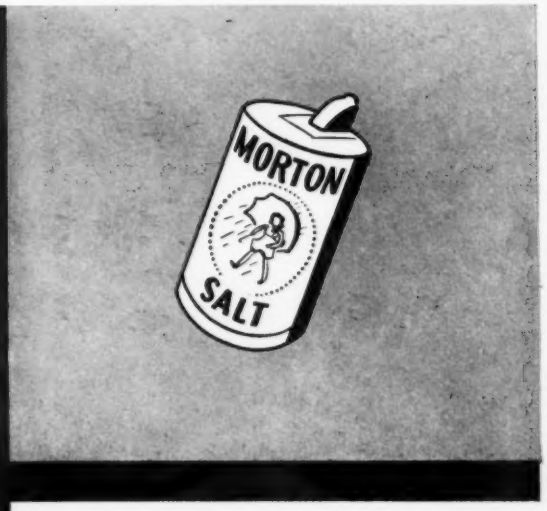
Send for the facts on efficiency of coal preparation in power plants with American Crushers.

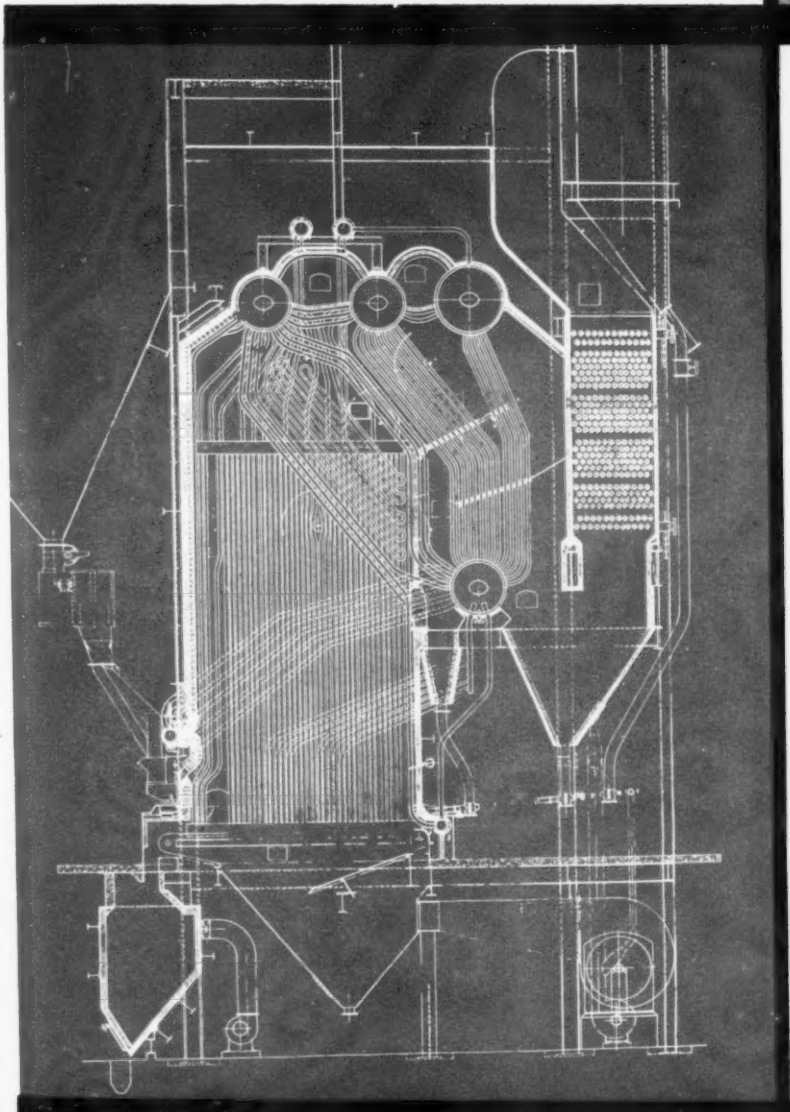
American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 Macklind Ave.
St. Louis 10, Mo.

Another WICKES BOILER for Morton Salt Company





When engineers of the Morton Salt Company specified a Wickes 4-Drum Boiler for the Morton plant at Manistee, Michigan, their choice was dictated in part by proven Wickes performance. For this is the *second Wickes boiler* installed at Morton's Manistee plant—evidence that *Wickes design and construction delivers the efficiency* that industry demands of a power generating unit. Cummins & Barnard, Inc., Engineers, of Ann Arbor, Michigan were consulting engineers on this installation. Specifications include: 180,000# steam per hour capacity, design pressure 700 psi, and total temperature 750° F. The advantages of Wickes 4-Drum Boiler design are readily apparent. Large diameter drums, minimum number of tube bends, and steam liberating area large enough to insure *rapid response to load changes.* For boilers of any type with capacities up to 250,000 lb. steam per hour and 850 psi, *consult Wickes first.* We are completely equipped to design and build boilers to specific requirements.

THE WICKES BOILER CO.

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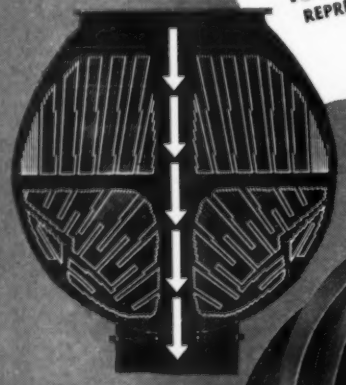
"Dual Bank" Efficiency in Any Size Condenser

High efficiency, which closely approaches the "theoretical ideal" in C. H. Wheeler "Dual Bank" Steam Condensers, is not limited to large, medium or small size units. Any size plant can obtain the operating benefits of a wide central steam lane, as indicated by arrows in the diagram of a large size "Dual Bank." The photo in the upper right shows a medium size "Dual Bank," with its central steam lane back of the vertical water box bridge. Note feeder lanes in both photo and diagram, which penetrate deep into the tube nests. Every tube does its share of condensing — no stagnant areas. Catalog No. 1461 tells the complete story of C. H. Wheeler "Dual Bank" Condensers in Standard, Reverse Flow and Divided Water Box Types. Write for it today.

C. H. WHEELER MFG. CO.
1800 Sedgley Avenue, Philadelphia 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES



Welded, Copper Bearing Steel Shell of a "Dual Bank" Surface Condenser

C.H. Wheeler

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COOLING TOWERS · HEAT EXCHANGERS
OF PHILADELPHIA

Let HARBISON-WALKER *help you solve your* REFRACTORY PROBLEMS!

H-W REFRACTORIES FOR BOILER SETTINGS

Developed through many years of close cooperation with boiler manufacturers and power plant operators, Harbison-Walker Power Plant Refractories are available in all commercial classes for your requirements. Our nearest representative will be glad for the opportunity of cooperating with you in the selection of the refractory that will give you the best service.

Not only are conditions severe for refractories in modern steam boiler settings—but rarely are two installations the same! Higher temperatures and drafts intensify the conditions that cause spalling, fluxing, and eroding of refractories. Each furnace has its own firing rate, fuel characteristics, slag conditions, details of design, operating temperatures, and other conditions.

The broad and extensive experience of Harbison-Walker in this and other fields of industry can guide you in the choice of refractories that will give the best service for *your* particular installation!

TRADE-MARK

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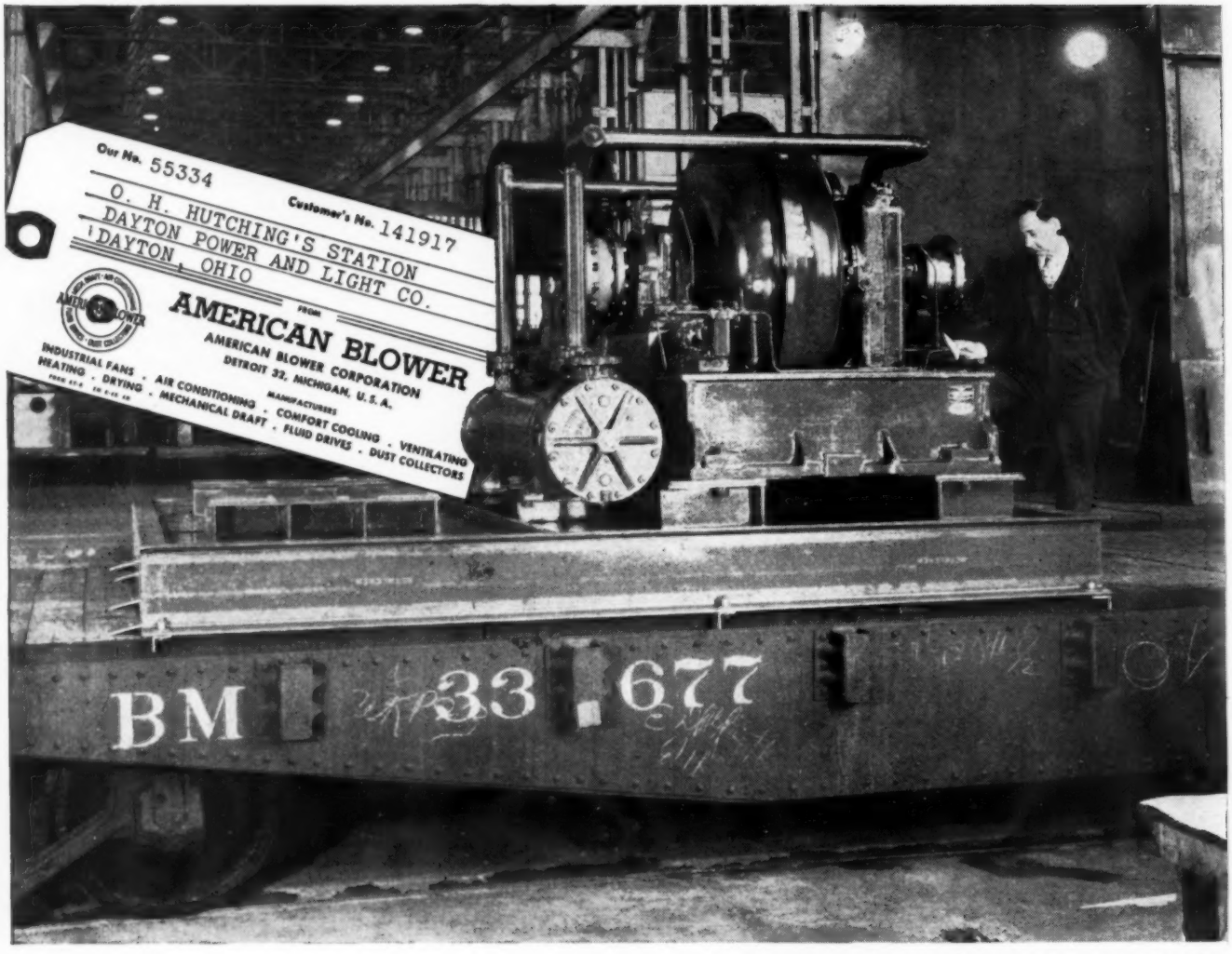
HARBISON-WALKER REFRACTORIES COMPANY

and Subsidiaries

WORLD'S LARGEST PRODUCER OF REFRACTORIES

GENERAL OFFICES, PITTSBURGH 22, PENNA.

Popular Prescription for Power Saving!


Our No. 55334
Customer's No. 141917
O. H. HUTCHING'S STATION
DAYTON POWER AND LIGHT CO.
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FROM
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MANUFACTURERS
INDUSTRIAL FANS · AIR CONDITIONING · COMFORT COOLING · VENTILATING
HEATING · DRYING · MECHANICAL DRAFT · FLUID DRIVES · DUST COLLECTORS
BM 33.677

American Blower Type PE 1250 HP Gýrol Fluid Drive for induced draft fans.

Yes, GÝROL FLUID DRIVE for adjustable speed control of mechanical draft fans and boiler feed pumps is getting more and more popular!

Why? Because Gýrol Fluid Drive saves power and increases over-all plant efficiency.

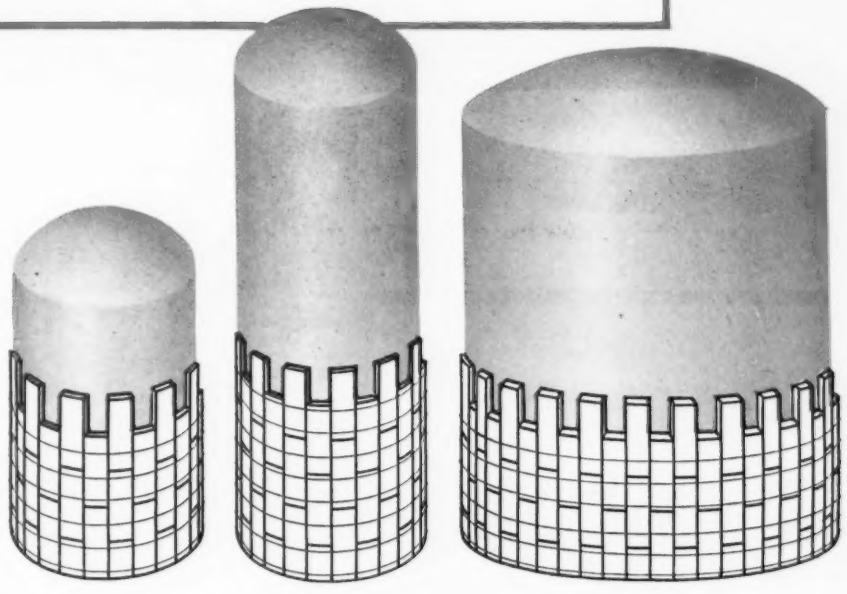
AMERICAN BLOWER CORP., DETROIT 32, MICH.
CANADIAN SIROCCO CO., LTD., WINDSOR, ONT.
Division of American Radiator & Standard Sanitary corporation

AMERICAN BLOWER

GÝROL *Fluid Drive*

Would YOU specify expansion joints in this tank insulation?

Here are three vessels used for processing heated liquids. The outside surfaces of all three are insulated with 85% Magnesia block. On which should expansion joints be provided in the insulation to prevent its cracking or moving?



A. stainless steel
600° F.
8′ diameter, 12′ high

B. steel lined with copper
300° F.
8′ diameter, 24′ high

C. carbon steel
480° F.
18′ diameter, 18′ high

Here's what the Armstrong engineer recommended:

When you're used to dealing with high temperatures, you're tempted to provide expansion joints for the insulation on practically every vessel, just to play safe. On the other hand, if you usually work with lower temperatures, you may not realize the need for such joints.

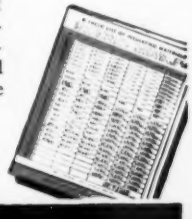
Expansion joints are an expensive luxury if the vessel doesn't actually need them, but a real necessity if it does. To conserve the most heat at the least cost for insulation, each vessel must be studied separately. In this case, one joint is needed on A, none on B, two on C.

Determining a question like this takes some digging. Expansion tables for various metals must be consulted and related to the known resilience of magnesia block. You can do this yourself or you can turn the job over to an Armstrong engineer. Checking details like this is part of Armstrong's service whenever you ask us to figure on a heat insulation contract.

Armstrong furnishes not only engineering knowhow for your installation but also correct materials and skilled workmanship. Before you contract for your next heat insulation job, investigate this complete service. All you have to do is call the nearest Armstrong Cork Co. office.

FREE INSULATION CHART

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write today to Armstrong Cork Company, Industrial Insulation Department, 7005 Maple Avenue, Lancaster, Pennsylvania.



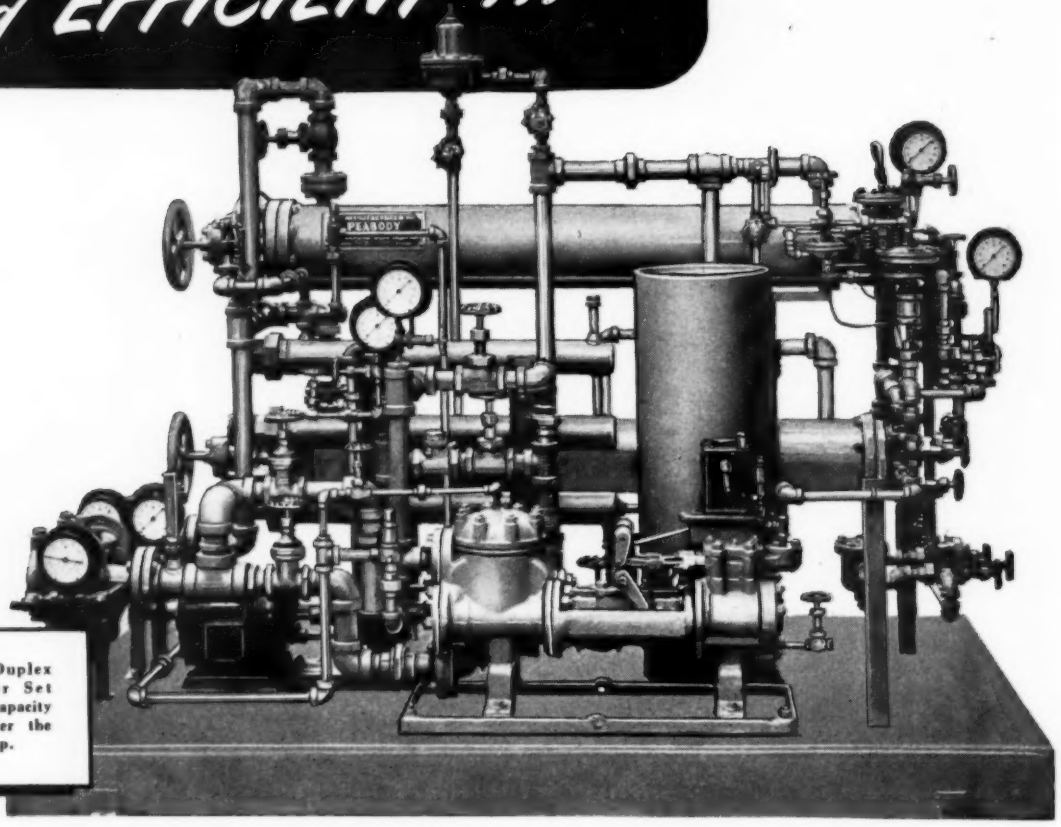
ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2800° Fahrenheit

COMPACT-COMPLETE and EFFICIENT . . .



Typical Peabody Duplex Pump and Heater Set equipped for full capacity operation using either the steam or electric pump.

FUEL OIL PUMP and HEATER SETS
designed for YOUR plant!

Maximum steam producing efficiency is a year 'round profit factor that operates 24 hours a day! Knowing this, Peabody Engineers designed their Pump and Heater Sets to deliver Bunker "C" or other heavy fuels to your burners at exact pressure and temperature requirements.

Rugged, dependable, and built for many years of trouble-free service, Peabody Pump and Heater Sets, engineered to *your* individual requirements, cut overall steam producing, labor, and maintenance costs and more than justify your *modernizing and economizing with Peabody.*

Here are only a few advantages you get in a Peabody installation:

Each installation designed to specific requirements • Compact, complete unit mounted on common base • Quick, easy installation • Clean fuel delivered to burners at proper temperature and pressure • All parts available for inspection and maintenance • Easily cleaned, with no "down time" • Minimum space required • Factory-built and tested, delivered ready to use • Low-mounted pumps, minimum suction lift

Complete details on request. Write for Bulletin 150.

PEABODY
ENGINEERING CORPORATION
580 FIFTH AVENUE • NEW YORK 19, N. Y.
Offices in Principal Cities

PH 1

RED TOP PIPE SUPPORTS

are easier and less costly to install

Through careful design and standardization, it has been possible to develop a line of pipe supports which is unique in that all requirements can be met by three models which differ only in capacity. To select the proper size 'RED TOP' merely calls for knowing the conditions involved in the installation and referring to a simple table which indicates the proper size to use.

By 'pre-engineering' RED TOP PIPE SUPPORTS in this manner, mass production can be concentrated on the three sizes which cover all supporting loads from 100 to 5000 pounds. We are thus able to make substantial production savings which are passed along to the user in lower prices. Definite savings in installation costs are assured.

IMMEDIATE DELIVERY of RED TOP PIPE SUPPORTS is made possible by ability to stock only a few sizes.

Write at once for full details. Ask for a copy of Catalog No. 316.

A few worthwhile sales territories are available. Investigate!

C. H. LEIBFRIED

Manufacturing Corporation

PIPE SUSPENSION DIVISION

IMMEDIATE DELIVERY

95 to 101 GUERNSEY ST.
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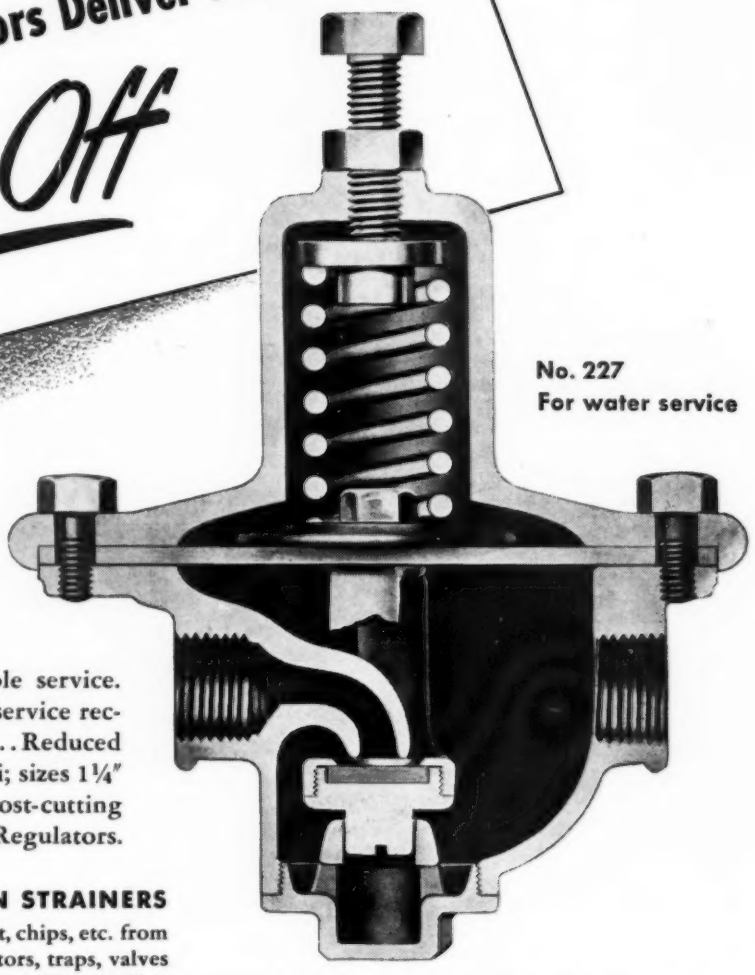
Masoneilan No. 227 Regulators Deliver Performance That Pays Off



No. 227
For water service

You don't have to baby Masoneilan Regulators because these rugged regulators are built to give continuous reducing service under most conditions.

You'll find thousands of these regulators in all types of industries giving dependable service. In fact, many are still going strong with a service record of over 25 years. Body Rating: 150 psi . . . Reduced Pressure Ranges: sizes ¼″ to 1″ — 10-60 psi; sizes 1¼″ to 2″ — 10-40; 30-60 psi. For long-lived, cost-cutting performance, specify and use Masoneilan Regulators.

MASONEILAN STRAINERS

Prevent scale, dirt, chips, etc. from damaging regulators, traps, valves and pumps . . . use Masoneilan Strainers. These precision-made strainers keep out all foreign matter. They'll eliminate maintenance delays and save you money.

MASON-NEILAN REGULATOR CO.
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New York • Buffalo • Chicago • St. Louis • Philadelphia • Houston
Pittsburgh • Cleveland • Cincinnati • Tulsa • Denver
Atlanta • Los Angeles • San Francisco • Mason Regulator Company of Canada, Ltd., Montreal and Toronto

MASONEILAN

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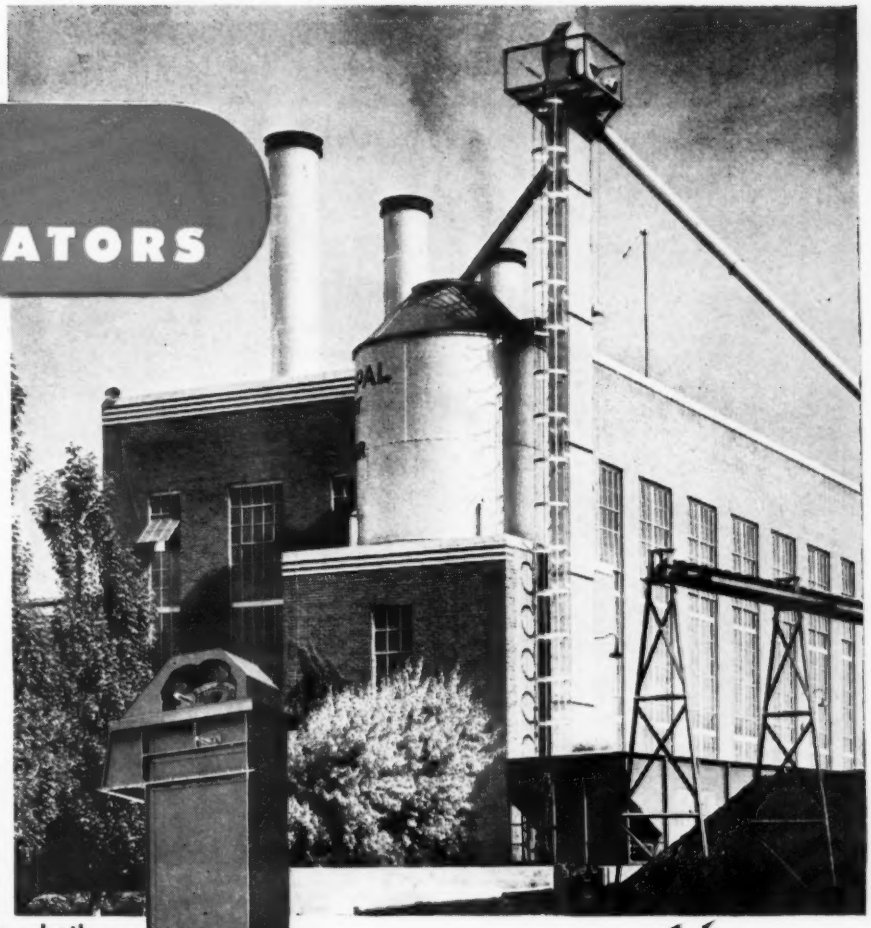
STANDARD BUCKET ELEVATORS

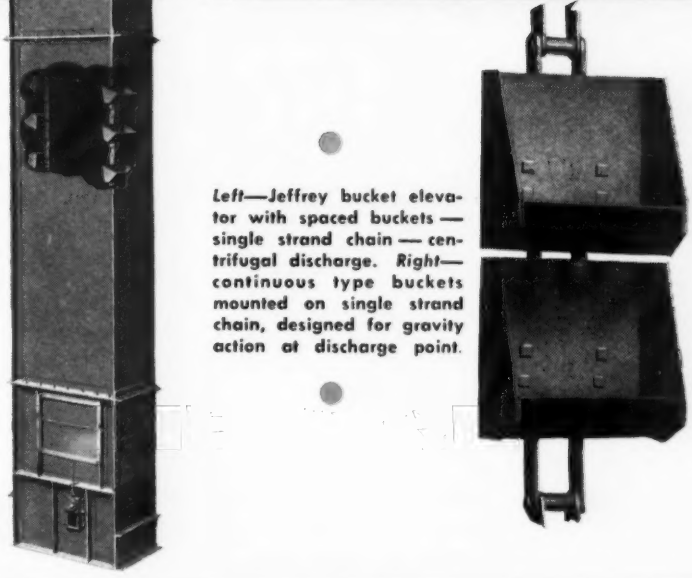


COAL and ashes handled — at low cost — minimum of space. Bucket Elevators — spaced or continuous buckets—of *standardized design*. In small plants — a complete system. The modern plant (see photo above) utilizes a silo which provides both a live and dead storage of large capacity.

Jeffrey bucket elevators have rigid angle construction — casing of heavy gauge steel — removable head — dust tight stuffing boxes on both head and countershaft — cut gears and chilled sprockets — standard HD journal bearings and steel boot — cleanout doors both sides.

SUPERMAL buckets if desired. Buckets mounted on single or double strand chain — or belt.

Send for Catalog No. 778-A which goes more into detail.



Left—Jeffrey bucket elevator with spaced buckets — single strand chain — centrifugal discharge. *Right*—continuous type buckets mounted on single strand chain, designed for gravity action at discharge point.

Track hoppers • feeders • distributing conveyors • weigh larries • skip hoists crushers • bin valves • chutes • car spotters

THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

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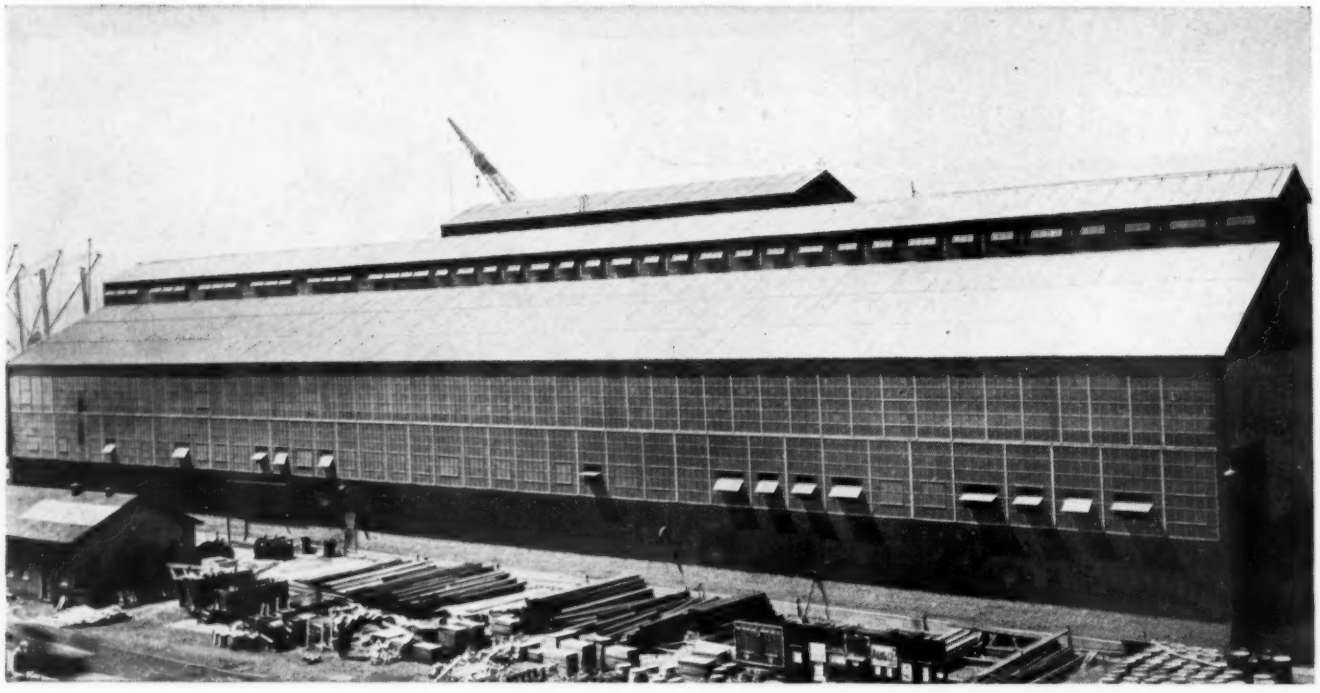
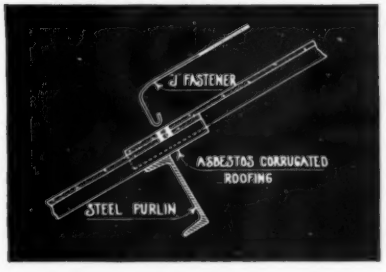
Philadelphia 3 · Scranton 3

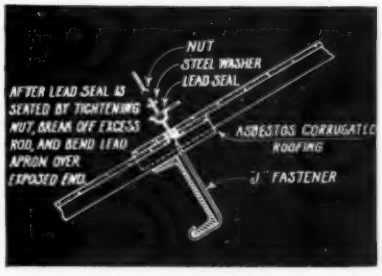
Complete Line of Material Handling, Processing and Mining Equipment

K&M "Century" ASBESTOS CORRUGATED



Details of one of the new TOP-SIDE Fasteners exclusive with K & M "Century" Asbestos Corrugated for roof installations.




NUT
STEEL WASHER
LEAD SEAL
AFTER LEAD SEAL IS SEATED BY TIGHTENING NUT, BREAK OFF EXCESS ROD, AND BEND LEAD APRON OVER EXPOSED END
ASBESTOS CORRUGATED ROOFING
J FASTENER

RESISTS CORROSION
right on the water front

The roof of this huge ship-building plant has to take a tough beating from the corrosive atmosphere of the river front. Thus it was natural that K&M "Century" Asbestos Corrugated should have been specified as the roofing material . . . for this durable asbestos-cement product is inherently immune to corrosion.

Of course, resistance to corrosion is but one of "Century" Corrugated's good points. It is completely fire-resistant. It won't rot . . . nor is it affected by the elements. Time only toughens it . . . no painting or other upkeep is needed.

The new TOP-SIDE Fasteners, available *only* with K&M "Century" Asbestos Corrugated, cut erection costs on roof installations over steel purlin construction. That's because TOP-SIDE fasteners can be applied wholly from the roof surface . . . thus eliminating the need for costly scaffolding beneath the roof.

If you are planning any remodeling or new construction, it will pay you to look further into the advantages of "Century" Corrugated. Write for full details.

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873.

DIAMOND ANNIVERSARY 1873 1948 K&M KEASBEY & MATTISON CO.

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HONEYWELL SERVICE

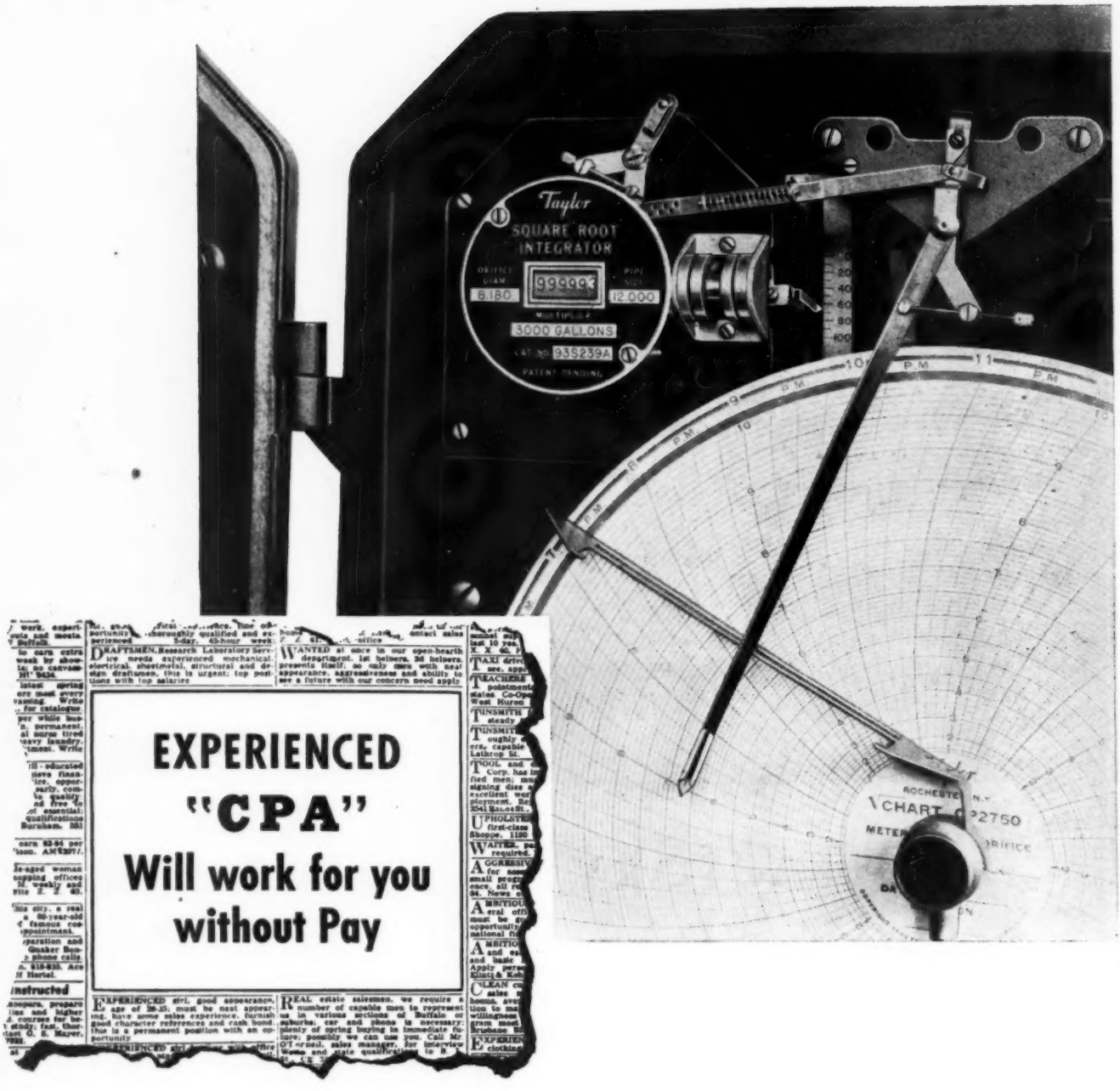
73 FACTORY BRANCHES FROM COAST TO COAST

WITH any product you use, you're after just one thing—RESULTS. That means the manufacturer's responsibility goes far beyond simply offering a good product. With Honeywell, this responsibility is accepted by service that begins when a job is in the plan stage, follows through at the time of installation—and Honeywell service carries on throughout the life of every installation to assure performance at the high standards to which every Honeywell product is made. To provide such service, Honeywell has 73 offices in the United States and Canada staffed with factory-trained engineers.

Today, most Honeywell modulating electric and pneumatic controls are available for *immediate delivery.* Specify Honeywell for your next control installation. This improved delivery service is insurance against delays. And remember that always on call is Honeywell service—the kind of comprehensive service that characterizes the leader in any field. Write or phone the Honeywell branch in or near your city. Minneapolis-Honeywell Regulator Co., 2607 Fourth Ave. So., Minneapolis 8, Minn. Canadian Plant: Toronto 12, Ontario.

MINNEAPOLIS **Honeywell**

CONTROL SYSTEMS

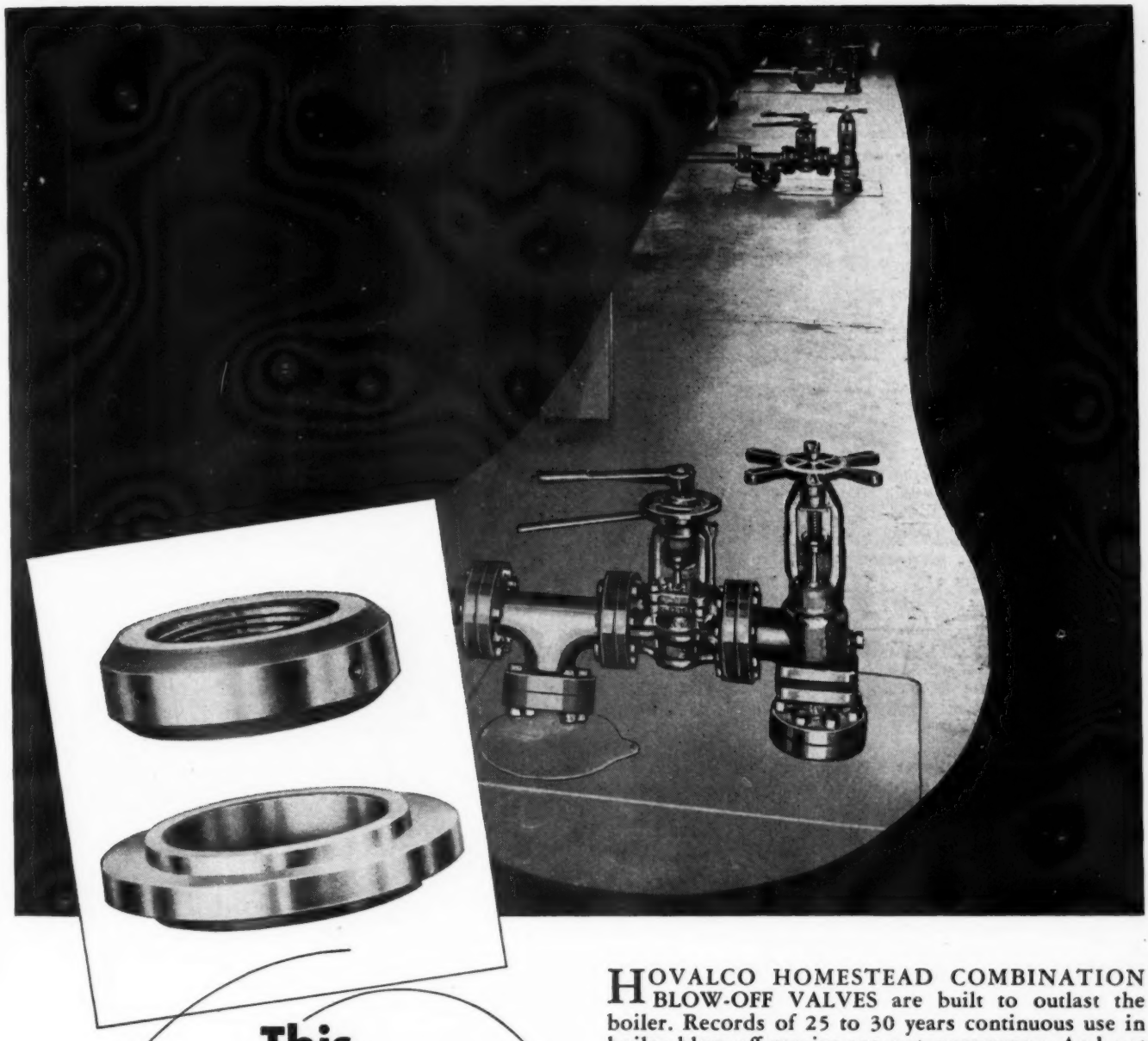


THIS Taylor Integrating Flowmeter can't sit down and figure out your income tax. But it can do one complicated and important job that might stump the best certified public accountant. And that is—give you accurate cost figures on consumption of steam for departmental processing and heating throughout your plant. Day in, day out, this new Flowmeter will accumulate and keep an accurate record of such data for ready reference. A glance at the chart will detect any abnormally high steam consumption caused by faulty operation of valves or traps.

The flowmeter precisely measures and records the rate of flow. At the same time, the Taylor Square Root Integrator accurately *totalizes* the flow of liquids, gases or steam. The Integrator is easy to read through a large (2-inch) window in the case door. Driven by positive, oil-proof clutch without ratchets. Ball bearing cam rollers and bushings require no lubrication. Convenient auxiliary scale gives continuous check on accuracy of calibration at any point of range. Both Oilite and ball bearings for long life. Few moving parts; permanently lubricated cam rollers, self-lubricated bushings; positive, oil-proof counter clutch.

For full details, ask your Taylor Field Engineer! Or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow and liquid level.*

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY



This

REVERSIBLE SEAT

means

DOUBLE VALVE LIFE

and 30% to 60% LESS MAINTENANCE EXPENSE

HOVALCO HOMESTEAD COMBINATION BLOW-OFF VALVES are built to outlast the boiler. Records of 25 to 30 years continuous use in boiler blow-off service are not uncommon. And not only do they have double the life span of ordinary valves, but they cost 30% to 60% less to maintain.

The HOVALCO ANGLE VALVE which takes all of the abuse and regulates the flow, is equipped with a special *reversible,* long wearing, "S" Monel seat and disc which is actually an "extra" set of accurately ground, perfectly matched seating surfaces ready to be put into service whenever the need arises. By simply unbolting the lower valve body and turning over the seat and disc, you have a good-as-new valve ready for another long lifetime of service.

Used in combination with HOMESTEAD LEVER-SEALD or CAM-SEALD QUARTER-TURN VALVES, they meet A.S.M.E. requirements and all state laws for boiler blow-off service.

We can furnish them in sizes 1½", 2" and 2½" for pressures to 600 pounds. Further detailed information and Valve Reference Book No. 38 will be mailed on request.

HOMESTEAD VALVE MANUFACTURING COMPANY

P. O. Box 210 **Coraopolis, Pa.**

Automatically and Positively—

GIVES INSTANT OVERLOAD PROTECTION

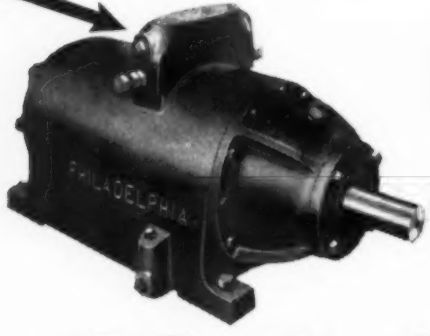
Philadelphia

PLANE TORQUE MOTOREDUCER

The "exclusive" Philadelphia PlaneTorque is a feature that can be incorporated into any Philadelphia MotoReduceR (as seen from the illustrations herewith).

By direct *mechanical actions* of the overload, the motor *current is automatically and instantly cut-off, as soon as a predetermined load limit is reached.* This action is *quicker* and *more positive* than electrical thermal relays. With "fuse protection," the fuses must be selected to carry the starting current of motors; therefore, protection during the running period is not adequate. Incidentally, the PlaneTorque can be cut-out during the starting period, by merely holding down the starting button, and upon release of said button it becomes operative again during the running period. To re-start the PlaneTorque (after it has cut-off from dangerous overload) merely remove the excessive load—a big time- and money-saving feature.

The PlaneTorque is ideal for Stoker drives, Conveyors, Crushers, Mixers, Rolls, Pulverizers and a "hundred and one" other machines. Write for Catalog MR45.



Philadelphia MotoReduceRs *are available in* Horizontal *(see cut at left) and Vertical (see cut above) types. They are the "last word" in self-contained, compact reduction drives, and are available in all required Horsepowers and Reduction Ratios, giving efficiencies as high as 97%. In addition, they are smooth and quiet in operation, and do not leak oil.*

Philadelphia

GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

anybody seen any bare tracts?

BTU's are constantly hunting for bare areas where no insulation—or inefficient insulation—gives heat energy a chance to escape. When they find them (and they do find plenty even in modern plants!) look out, mister, look out! They blast away . . . there's buckshot galore . . . and careful cost estimates are shot full of holes! *Dollars assigned to production of heat energy are wasted!*

CAREY KEEPS BTU'S ON TARGET! The best way to keep BTU's firing straight at production goals is to take advantage of **CAREY'S** *Complete Industrial Insulation Service.* Developed by over 60 years of helping industry *locate and eliminate* leaks in heat energy, it includes:

1. Practical engineering experience gained from detailed development of industrial insulation jobs of all sizes and shapes.
2. A complete line of industrial insulation materials, including—

   85% MAGNESIA, ASBESTOS, INDUSTRIAL ROCK WOOL

3. Materials strategically warehoused from coast to coast.

AVAILABLE TO HELP YOU! Carey's Complete Industrial Insulation Service is set up to give you everything from an insulation survey to a complete installation . . . to keep industry's BTU's on the job. Make full use of it at any time! Meanwhile you'll want to . . .

Write for your free copy of "Heat Insulation For Industry." This helpful booklet is an excellent guide to selection of industrial insulation—contains specifications and tables you'll want to keep handy. For your *free* copy address your request to Dept. PO-5.

Carey 75 *years serving home and industry*

THE PHILIP CAREY MANUFACTURING CO., CINCINNATI 15, OHIO

In Canada: The Philip Carey Co., Ltd.
1557 MacKay St., Montreal 25, P. Q.

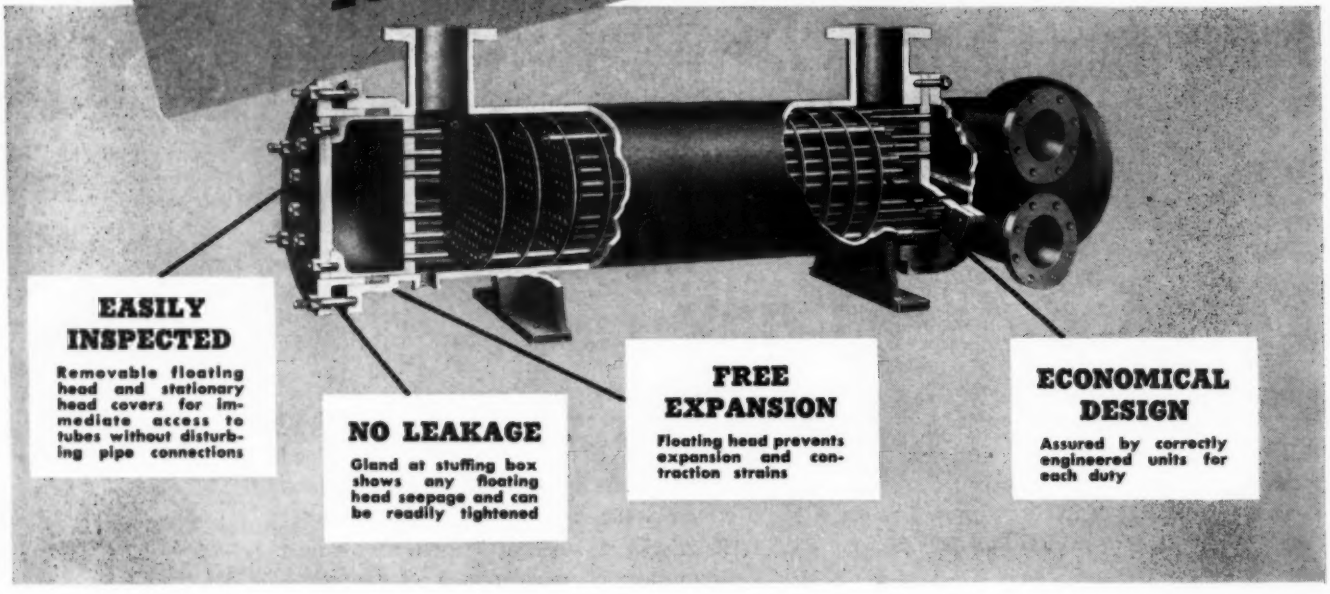
85% MAGNESIA
INDUSTRIAL ROCK WOOL
ASBESTOS

Pipe Coverings • Sheets • Blocks
Batts • Papers • Air-Cell

USE

G-R MULTIWHIRL COOLERS for cooling

- LUBRICATING OIL
- TRANSFORMER OIL
- DIESEL JACKET WATER
- CIRCULATING WATER
- WASTE LIQUORS



EASILY INSPECTED

Removable floating head and stationary head covers for immediate access to tubes without disturbing pipe connections

NO LEAKAGE

Gland at stuffing box shows any floating head seepage and can be readily tightened

FREE EXPANSION

Floating head prevents expansion and contraction strains

ECONOMICAL DESIGN

Assured by correctly engineered units for each duty

These important advantages of the G-R Multiwhirl Cooler for cooling . . . for heat recovery . . . on many liquid services have been proven in thousands of installations. They indicate some of the reasons why these units assure effective heat transfer and lastingly satisfactory service with greatest convenience and least expense for attendance and maintenance.

If your power-generating equipment or plant processes require cooling of liquids, be sure to investigate the G-R Multiwhirl Cooler. Write for bulletin describing these units in detail.

THE GRISCOM-RUSSELL CO.
285 Madison Ave., New York 17, N. Y.

GR-197

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

WHAT CAUSES

IN BOILERS?

The principal causes of corrosion in boilers are acidity (low pH) and dissolved oxygen. In some cases electrolytic action and high alkalinity are factors that have to be considered.

DREW Power Plant Chemicals and Services have been developed for the prevention of all types of corrosion and for handling the other difficulties encountered in the use of industrial water.

Our engineers are always at your service.

E. F. DREW & CO., INC.

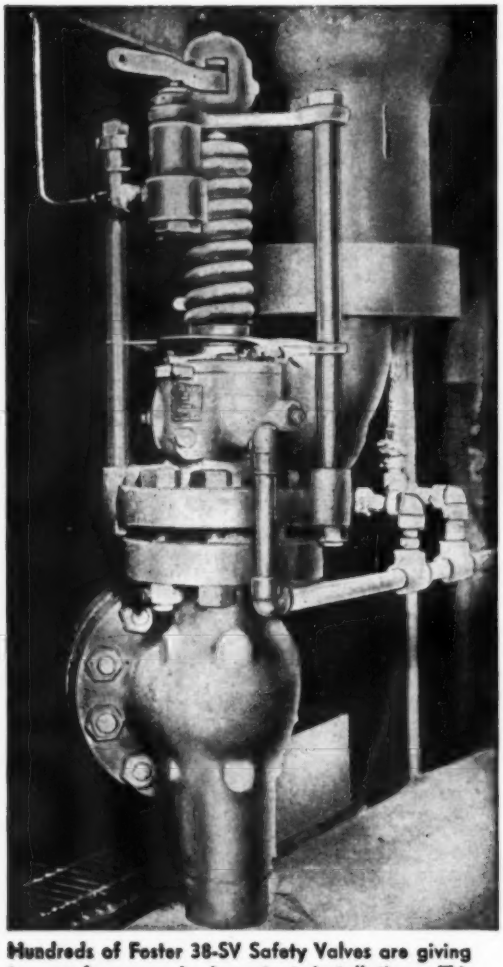
15 East 26th Street, New York 10, N. Y.
Chicago: 360 North Michigan Avenue
San Francisco: 440 Golden Gate Avenue

POWER DREW CHEMICALS

Complete Service by Drew Engineers is Available in Key Cities of the United States, Canada, Mexico, Brazil, Argentina and Puerto Rico.

Give Your Boilers a Break!

End Safety Valve Troubles by Installing FOSTER 38-SV Safety Valves with these 5 GUARANTEED ADVANTAGES:



Hundreds of Foster 38-SV Safety Valves are giving top performance in important installations. This 2½" superheater unloading valve operates at 1450 lb., 950° total temp. Others are in service up to 2575 lb. at 1000° F.

1 Built to Stay on the Job—the Foster 38-SV is the SAFETY valve that is built to pop without causing boiler outages. On accelerated tests in an Eastern Utility, one of these valves has been popped every day for more than 6 years. It has had only routine maintenance, and yet it pops consistently at set pressure, and does not leak. In the Chief Engineer's own words—this is the equivalent of at least 40 years' normal service.

2 Accurate Popping—Once set at the desired popping point, the Foster 38-SV pops on the button for each successive pop. For instance, in another Utility installation, the 38-SV under test was set for 600 lb. and popped 50 times in quick succession. The first pop was at 600 lb. and the 50th pop was at 595 lb. In spite of the heat of this abnormal operation, the Foster 38-SV was thrown off less than 1%. After a short cooling period, it again popped at 600 lb. That's test gauge accuracy!

3 Minimum Blow-down—Foster 38-SV's are adjustable so they can be set to reseat when pressure has dropped as little as 1% below the popping point. In this same test the 38-SV, on its first pop, reseated at 594 lb. for a 6 lb. or 1% blow-down. On the 50th pop, it reseated at 589 lb. which is also 6 lb. or 1%. After each pop, it reseated positively with no chattering or leakage. Only over-pressure up the stack—no useful steam wasted.

4 High Relief Capacity—Foster 38-SV's have larger bore because they can handle larger volume of steam and still control blow-down. Depending on operating conditions, they may give more than twice the capacity of other makes, as in the case of 5 Foster 38-SV's required to replace 12 "conventional" safety valves of the same nominal size. Fewer valves to buy—fewer valves to service.

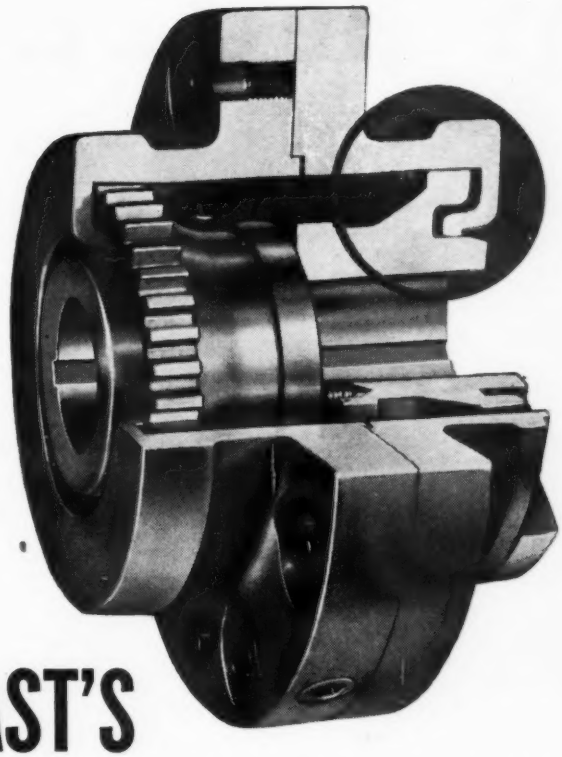
5 Low Maintenance—Hot or cold, the piston in the 38-SV fits loosely and cannot stick, and yet no steam reaches the spring. The spring stays cool enough to touch, even while the valve is popping—which means longer spring life. Disc and seat expand at the same rate during heating-cooling cycles—there is no drag to destroy seating surfaces. Simmering and chattering have been eliminated as a source of destruction. Discs will not warp or crack. When routine inspection and maintenance are indicated, complete loading assembly lifts out without disturbing the spring setting.

For full details on the design and construction features that enable this valve to outperform any other safety valve, get in touch with your Foster Representative or with us direct.

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS... PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

106 MONROE STREET • NEWARK, N. J.



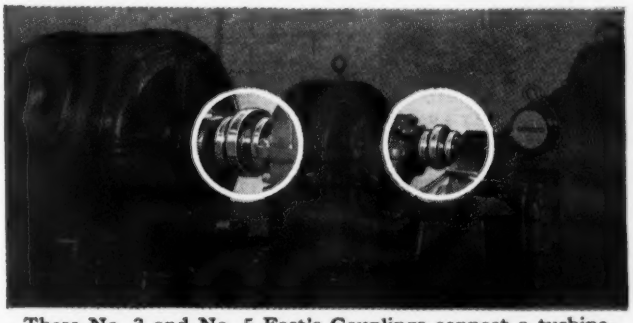
FAST'S

ALL-STEEL Construction Gives NON-STOP Power Transmission!

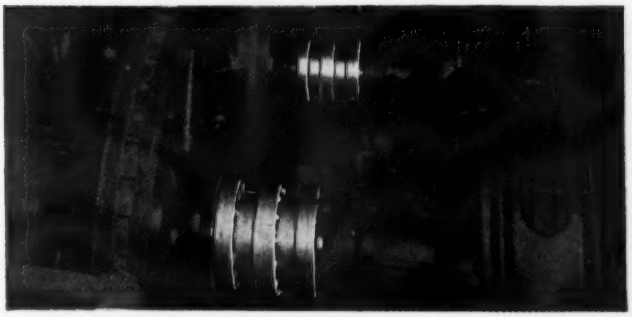
These installations have an important feature in common. They're all protected against coupling shutdowns by Fast's self-aligning Couplings. That's because these original gear-type couplings are all-steel throughout, *without perishable parts!* Even the load-carrying oil is protected by an *exclusive* "rocking bearing." This bearing is *exclusive* in providing a positive metal-to-metal seal which keeps out moisture, dust and grit. The bearing is also *exclusive* in its correctly engineered position which allows *freedom of movement* to compensate for misalignment because its *spherical* base has *the same axis* as the hub spline faces. No perishable packing rings are used in this vital spot.

We have a complete line of couplings for immediate delivery. No matter which type of Fast's Couplings you buy, you get the benefits of years of top engineering experience, Koppers' high standards of workmanship and unexcelled coupling service which assure you of spare parts no matter how old your couplings may be. That means non-stop power transmission, longer machine life, lower costs, minimum shutdown losses! Koppers Co., Inc., Fast's Coupling Dept., 245 Scott St., Baltimore 3, Maryland.

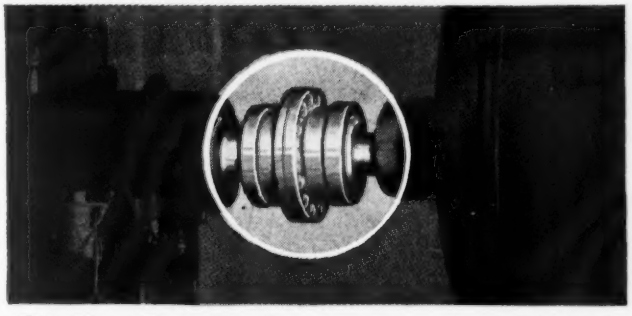
Fast's Coupling connects 1,800 h.p., 600 r.p.m. motor to 30 million-gallon-per-hour pump at City of Montreal pumping station.



These No. 3 and No. 5 Fast's Couplings connect a turbine-reduction gear-generator hookup, 1125 h.p. at 3740/1200 r.p.m., at Firestone Steel Products Co., Akron, Ohio.



This group of Fast's Couplings has been giving trouble-free service since 1922 at the Western Maryland Dairy Company's Baltimore plant.



This No. 4 Fast's Coupling connects a motor and induced draft fan at the West Penn Power Company's Beach Bottom, W. Va., plant.

K KOPPERS

FAST'S *self-aligning* COUPLINGS

SEND FOR FREE CATALOG giving detailed descriptions, engineering drawings, dimension and capacity tables and typical installation photographs for the many types of Fast's Couplings. Fill out this coupon and mail it to: Koppers Co., Inc., Fast's Coupling Dept., 245 Scott St., Baltimore 3, Md.

NAME.....POSITION.....

COMPANY.....

STREET.....CITY.....STATE.....

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Maintenance of Condenser and Heat Exchanger Equipment

With rising costs plus constant demand for maximum operating efficiency and the need for reducing shutdown time on condenser and heat exchanger equipment to a minimum, plant management and engineering executives face a number of problems.

Under today's higher costs for labor, materials and equipment, careful consideration should be given as to whether an outside service should supplement the existing organization for the maintenance of condensers and heat exchangers.

Speed of Service Important

Most of the organizations specializing in the repair and maintenance of vital condenser and heat exchanger equipment are staffed with special crews for twenty-four-hour-a-day service on emergency work. And it is usually true that any shutdown where standby equipment is not available is an emergency job.

Trained repair crews with full equipment operate as 'round-the-clock flying squads, and this service feature has proved invaluable to many operators in times of breakdown. This service is available for ships, power stations, refineries and chemical plants. With special tools, techniques and experienced crews, the valuable shutdown time can be considerably reduced.

Advantage of Wide Experience

Among the advantages usually obtained in utilizing the services of a "specialist" organization are, of course, the broad experience and "know how" gained through their work with many types of equipment for use under various service conditions. Such an organization frequently is in a position to make suggestions and recommendations concerning the equipment, layout, design, selection of replacement parts and materials that can make important contributions to more efficient operation, longer service life, or both.

Such organizations frequently are employed in serving similar installations in the locality of a given plant. They are generally familiar with local conditions and are in a position to bring to a job the benefit of such experience.

A second advantage is the specialized facilities and equipment maintained by such condenser and heat exchanger service organizations. They are equipped to do "on the job" repair work and replacement as well as complete rebuilding or retubing of corroded or obsolete equipment in their own shops. Through such facilities, equipment that might otherwise have been destined for the "scrap heap" can frequently be salvaged.

Such shops are often well-equipped with machine shop, heavy duty welders and foundry not only for general repairs, retubing and normal maintenance such as cleaning, but for building brand new condensers and heat exchangers to meet specific requirements.

Early "Diagnosis" Prevents Troubles

Another function of service companies is periodic inspection and testing of equipment which frequently enables service engineers to locate or anticipate possible trouble before it occurs.

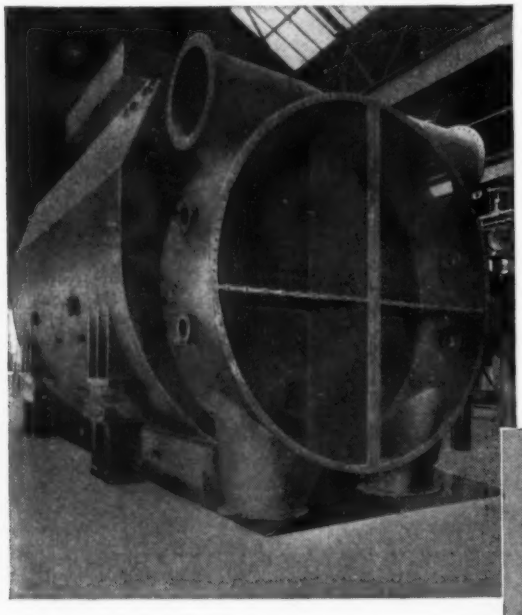
Savings resulting from such early diagnosis of possible trouble spots are difficult to calculate in terms of dollars and cents. It is important to plan a maintenance program to provide greatest efficiency for the conditions in a given plant or company operating several plants over a wide territory.

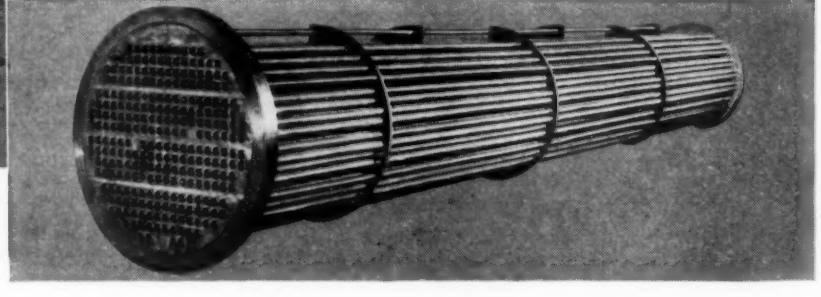
Condenser Tube Stocks

To take care of emergency service and breakdowns, Bridgeport maintains stocks of condenser and heat exchanger tubes in our warehouses in St. Louis, Houston, Los Angeles and San Francisco, which supplement the service of our offices and other warehouses located in principal cities throughout the country, and of our mills at Bridgeport and Indianapolis. We aim to carry sizes which will take care of local needs. Operators who plan to retube their condensers should anticipate their requirements and place their orders early with the mill to avoid disappointment in deliveries. It is suggested that the tubing for new installations should be ordered at the same time as the equipment to eliminate unnecessary delays.

Operators can obtain help from our laboratory to select the alloy which will give the longest service life. Working closely with operators and engineers, Bridgeport has accumulated many valuable performance records of tubing under a wide range of operating conditions.

Much information on the character of the different types of alloys used in these fields can be found in our Condenser Tube Manual. Write for a copy on business stationery.





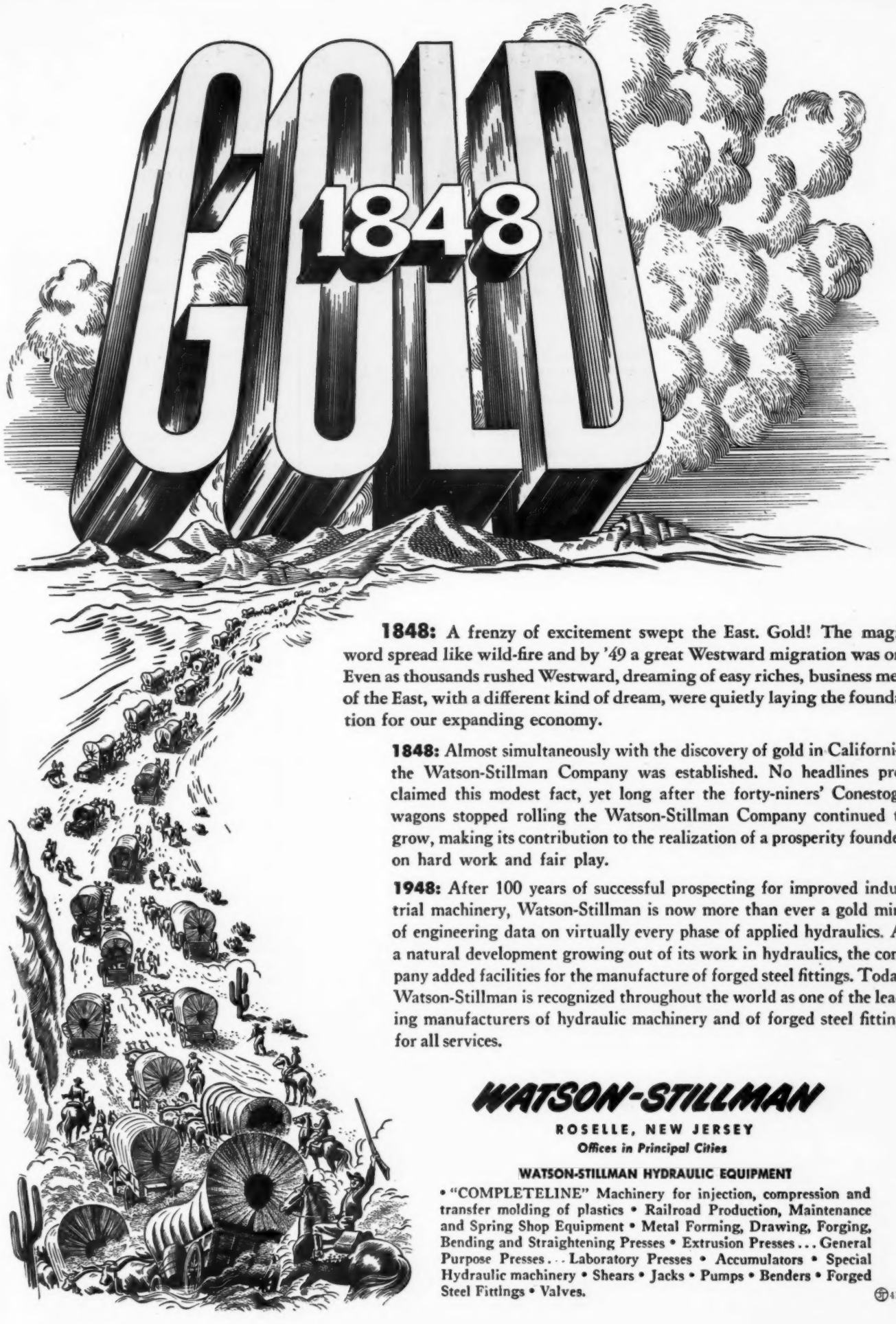
ABOVE: 33,000 sq. ft., 2-pass divided-flow condenser. Courtesy Condenser Service & Engineering Co., Inc.

RIGHT: Tube bundle of type FST. Courtesy The Griscom-Russell Company.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*

Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal



1848: A frenzy of excitement swept the East. Gold! The magic word spread like wild-fire and by '49 a great Westward migration was on. Even as thousands rushed Westward, dreaming of easy riches, business men of the East, with a different kind of dream, were quietly laying the foundation for our expanding economy.

1848: Almost simultaneously with the discovery of gold in California, the Watson-Stillman Company was established. No headlines proclaimed this modest fact, yet long after the forty-niners' Conestoga wagons stopped rolling the Watson-Stillman Company continued to grow, making its contribution to the realization of a prosperity founded on hard work and fair play.

1948: After 100 years of successful prospecting for improved industrial machinery, Watson-Stillman is now more than ever a gold mine of engineering data on virtually every phase of applied hydraulics. As a natural development growing out of its work in hydraulics, the company added facilities for the manufacture of forged steel fittings. Today, Watson-Stillman is recognized throughout the world as one of the leading manufacturers of hydraulic machinery and of forged steel fittings for all services.

WATSON-STILLMAN

ROSELLE, NEW JERSEY

Offices in Principal Cities

WATSON-STILLMAN HYDRAULIC EQUIPMENT

• "COMPLETELINE" Machinery for injection, compression and transfer molding of plastics • Railroad Production, Maintenance and Spring Shop Equipment • Metal Forming, Drawing, Forging, Bending and Straightening Presses • Extrusion Presses . . . General Purpose Presses . . . Laboratory Presses • Accumulators • Special Hydraulic machinery • Shears • Jacks • Pumps • Benders • Forged Steel Fittings • Valves.

4131

GETTING MORE LOW-COST STEAM

Greater steaming capacity for longer periods of uninterrupted service is assured by using a CARBOFRAX silicon carbide brick boiler setting. Its use improves overall efficiency —effects noteworthy operating economy—lowers maintenance costs.

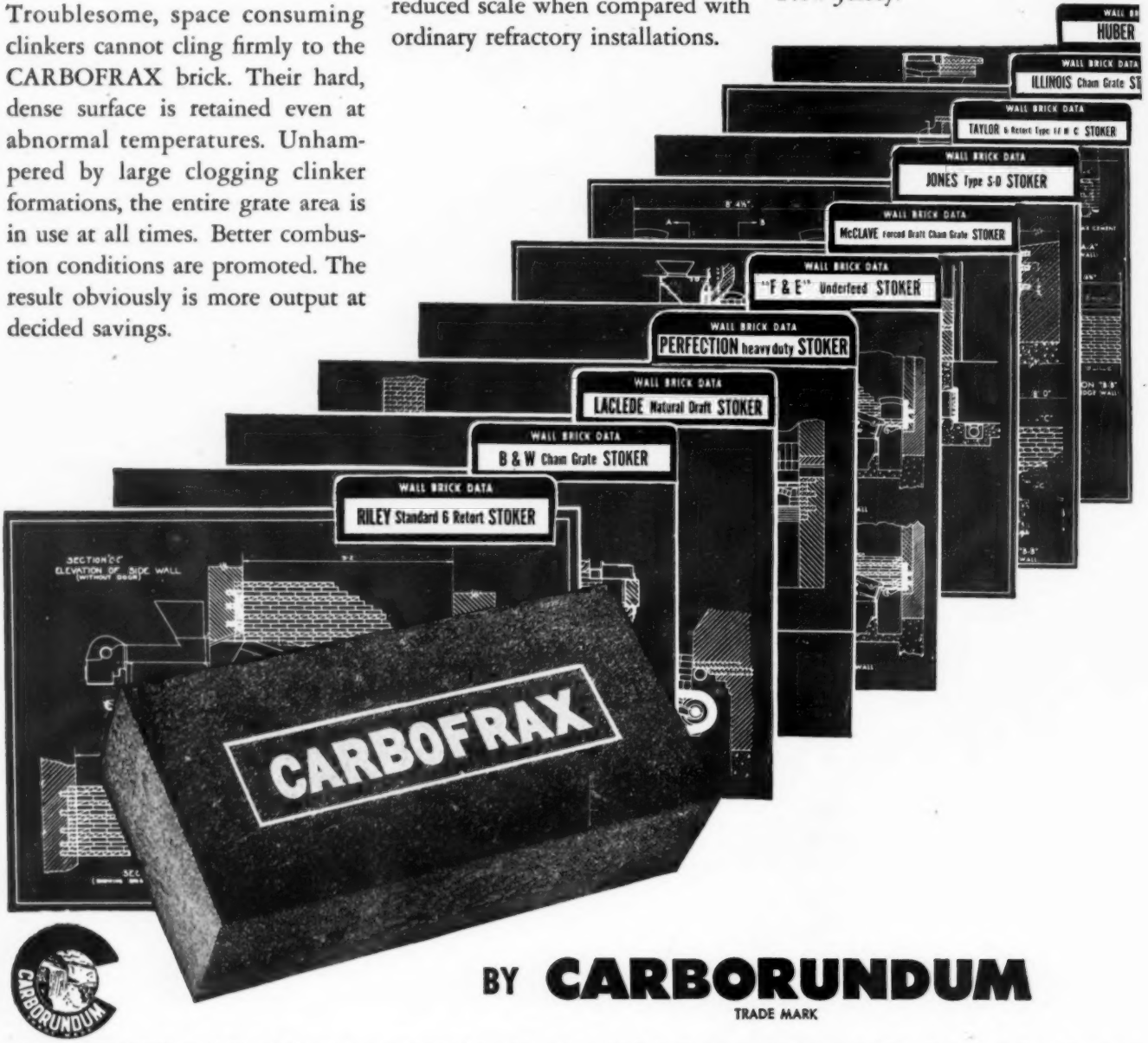
Troublesome, space consuming clinkers cannot cling firmly to the CARBOFRAX brick. Their hard, dense surface is retained even at abnormal temperatures. Unhampered by large clogging clinker formations, the entire grate area is in use at all times. Better combustion conditions are promoted. The result obviously is more output at decided savings.

Service life of 8 to 10 years from CARBOFRAX brick without replacement is regularly reported. Outages for setting repairs are rare because of the extreme resistance to abrasion, spalling and cracking possessed by these brick. Any maintenance expense is on a greatly reduced scale when compared with ordinary refractory installations.

Further savings are realized from the longer life of the upper walls. Being firmly supported by the erosion resistant CARBOFRAX setting, these walls do not require frequent rebuilding or replacement.

It will pay you to discuss more fully the benefits of a CARBOFRAX setting for your boiler furnace. We will be glad to supply the details. To get a preliminary summary of pertinent facts, write Dept. E-58 for your copy of our illustrated technical booklet.

The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.



BY **CARBORUNDUM**
TRADE MARK

"Carborundum" and "Carbofrax" are registered trademarks which indicate manufacture by The Carborundum Company

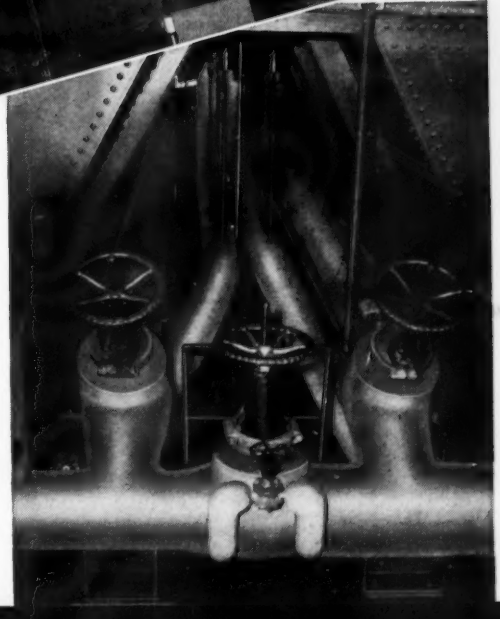
POWER PIPING REQUIRING

EXTREME PRESSURES . . . HIGH TEMPERATURES . . . COMPLICATED ASSEMBLIES . . . FULL FURNACE HEAT TREATING . . . X-RAY INSPECTION

CALLS FOR

BLAW-KNOX

POWER PIPING



The installation illustrated: Newly completed power plant at Alma, Wisconsin. Owners: Dairyland Power Cooperative, LaCrosse. Design and construction supervision by Vern E. Alden Company, Engineers, Chicago. All Power Piping by Blaw-Knox POWER PIPING. Main steam piping for 875 psi at 900°F. Boiler feed piping for 1320 psi at 450°F.

POWER PIPING
DIVISION OF BLAW-KNOX COMPANY
1525 Pennsylvania Ave., N. S., Pittsburgh 12, Pa.
Offices in Principal Cities

COCHRANE

Cochrane Deaerator

Carbite

CARBONACEOUS ZEOLITE

SOFTENERS

at FROEDTERT
World's Largest Malting Company

IN this modernized boiler plant of the Froedtert Grain and Malting Company, Inc. at Milwaukee, Wisc., water from the twin sodium-regenerated Cochrane Carbite Softeners is blended with water from the twin acid-regenerated Cochrane Carbite Softeners and then passed to the Cochrane Decarbonator on the floor above for removal of CO_2. After being mixed with returning condensate filtered through Cochrane Oil Removal Filters, the combined feed water passes through the Cochrane Deaerator at the top to insure "zero" oxygen.

COCHRANE CORPORATION
3106 N. 17th St. Philadelphia 32, Pa.

Cochrane Decarbonator for removal of dissolved CO_2 gas

TWIN ACID-REGENER-ATED CARBITE SOFTENERS

TWIN SODIUM REGENER-ATED CARBITE SOFTENERS

Write for a copy of Publication 4021

COCHRANE

OIC

PACE-SETTER IN VALVES

"TAILORS" *the* TRIM

TO SAVE YOU MONEY!

OIC FORGED STEEL AND CAST STEEL VALVE TRIM CHART

Service	Steam, Water or Gas				Oil or Oil Vapor	
Temperature Limitation	550°F. "B" Trim*	750°F. "N" Trim	750°F. "HCH" Trim	1000°F. "U" Trim†	850°F. "C" Trim	1000°F. "CH" Trim
Stem	Manganese Bronze	13% Chrome Stainless Steel				
Wedge (Gates)	Bronze	13% Chrome Stainless	13% Chrome Stainless Hardened 500 Brinell	Stellite	13% Chrome Stainless Steel	
Seats (Gates)	Bronze	Nickel-Copper	13% Chrome Stainless Steel	Stellite	13% Chrome Stainless Steel	
Discs (Globes)	Bronze	Nickel-Copper		Stellite	13% Chrome Stainless Steel	
Seats (Globes)	Bronze	13% Chrome Stainless		Stellite	13% Chrome Stainless Steel	
Bonnet Gasket	Asbestos	Corrugated Soft Iron				
Bolting	ASTM A261 Grade B0	ASTM A193 Grade B7	ASTM A193 Grade B14	ASTM A193 Grade B14	ASTM A193 Grade B7	ASTM A193 Grade B14

* Regularly available in 150 and 300 lbs. valves.
† Regularly available in valves rated 300 lbs. and higher.
Other trims and combinations of trims for special applications available upon request.

"Tailored trim" in OIC Valves means less wear, longer service with less maintenance. All trim surfaces in OIC Valves are finished to a highly polished smoothness by modern, scientifically designed machinery — shaving friction to the lowest possible coefficient. Every OIC valve trim is especially made for its particular job! Cut operating costs to a new low with OIC, Pace-Setter in Valves!

GET THE FACTS ABOUT OIC'S "TAILORED TRIM" IN THE BIG OIC 248-PAGE CATALOG

And there's plenty of other useful information that you won't want to miss in this handy book. For your free copy, simply write, giving your name, firm and address to The Ohio Injector Company, Wadsworth, Ohio.

0-248-11

OIC VALVES

STEEL • IRON • BRONZE

HEAT...and how to take it!

A lot of things can happen when metal runs a temperature—particularly the high temperatures common in power plant operation nowadays.

Heat treatment, to compensate for changes in metallic structure during the fabricating of power piping, is the only way in which the optimum metallurgical condition can be obtained and hidden stresses avoided—the most economical way in which power piping can be made to run hot, without getting bothered.

Here at Kellogg our fabricating division works hand-in-glove with our metallurgical laboratory. Power piping is given preventive heat treatment after any hot working such as bending or welding—scientifically, according to the particular characteristics of the metal best suited for the job.

Equally important is the fact that Kellogg facilities for normalizing and stress-relieving operations are among the most complete, accurate and extensive in industry—including heat treating furnaces big enough to hold an 80 foot railroad car!

It's extra knowledge and extra care like this that accounts for the plus quality in a Kellogg job—the reason why so many of the world's top industries turn to Kellogg when perfection is all-important.

FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

A SUBSIDIARY OF PULLMAN INC.

NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES
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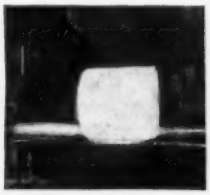
VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING
PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.



Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

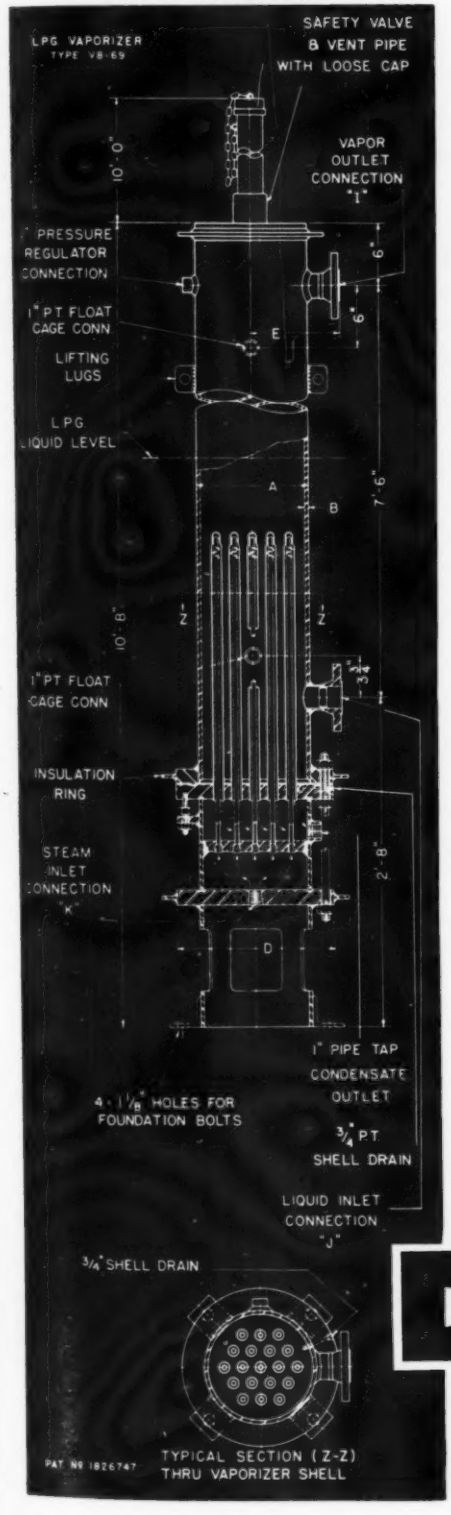
On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.

Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

"HOT PLATE" LPG STEAM VAPORIZER

for Medium and High Capacity L. P. G. SYSTEMS

Paracoil


LPG VAPORIZER TYPE V8-69
SAFETY VALVE & VENT PIPE WITH LOOSE CAP
VAPOR OUTLET CONNECTION "I"
1" PRESSURE REGULATOR CONNECTION
1" PT FLOAT GAGE CONN
LIFTING LUGS
L.P.G. LIQUID LEVEL
1" PT FLOAT GAGE CONN
INSULATION RING
STEAM INLET CONNECTION "K"
1" PIPE TAP CONDENSATE OUTLET
4 - 1 1/8" HOLES FOR FOUNDATION BOLTS
3/4" P.T. SHELL DRAIN
LIQUID INLET CONNECTION "J"
3/4" SHELL DRAIN
PAT. NO 1826747
TYPICAL SECTION (Z-Z) THRU VAPORIZER SHELL

When plant site weather conditions are sufficiently severe as to indicate the use of a Vaporizer with your L.P.G. system, the Paracoil "Hot-Plate" Steam Vaporizer offers operating advantages possessed by no other unit.

FEATURES

- **PATENTED "HOT-PLATE" NON-FREEZING CONDENSATE DRAINAGE SYSTEM.**
- **Installed Above Ground—Entirely Outside the Storage Tank. Can be used with Any Type of L.P. Gas.**
- **High Output Capacity—Up to 1000 Gallons Per Hour Per Unit.**
- **Fully Automatic in Operation.**
- **No Moving Parts—Nothing to Get Out of Order.**
- **Fitted with Approved Type Relief Valve.**
- **No Vaporizer Flames Used—Operates on Low Pressure or Exhaust Steam.**
- **Easy Access to Heating Surface for Inspection.**

SIZE NO.	CAPACITY GALS./HR.	DATA A	B	D	E	K	I	J	SAFETY VALVE SIZE	WEIGHT LBS.
H-24S	125	10¾	.365	15⅛	9½	1	2	2	1½	770
K-24S	200	12¾	.375	17¼	10½	1	2	2	1½	1100
L-24S	300	14	.375	18½	11¼	1	2	2	1½	1260
N-24S	500	16	.375	20½	12½	1½	2	2	1½	1590
T-24S	1000	22	.375	26½	16	2	2	2	2½	2690

All Dimensions in Inches — Dwg. 1-14568-B

SPECIFICATIONS

MATERIAL

Outer Shell	—Seamless Steel Pipe
Outer Vaporizing Tubes	—⅞" OD 16 BWG Seamless Steel
Inner Steam Conveyor Tubes	—½" OD x 20 BWG Seamless Copper
Tube Sheets and Flanges	—Rolled Steel Plate
Steam and Condensate Channels	—Welded Steel
Supporting Base	—Welded Steel

DESIGN

A.S.M.E. Code, Par. U-69
N.B.F.U. Pamphlet No. 58, Spec. B.10.i

Working Pressure:	Shell	250 PSIG	(Liquid Vapor Side)
	Tubes	200 PSIG	(Steam Side)
Test Pressure:	Shell	500 PSIG	Hydrostatic
	Tubes	400 PSIG	Hydrostatic

Liquid Inlet Connection — 300 Lb. Design
Vapor Outlet Connection — 300 Lb. Design

ASME CODE CONSTRUCTION—HARTFORD INSPECTED
MEETS ALL N.B.F.U. REGULATIONS
WRITE FOR ENGINEERING DATA AND PRICES

DAVIS
ENGINEERING CORPORATION

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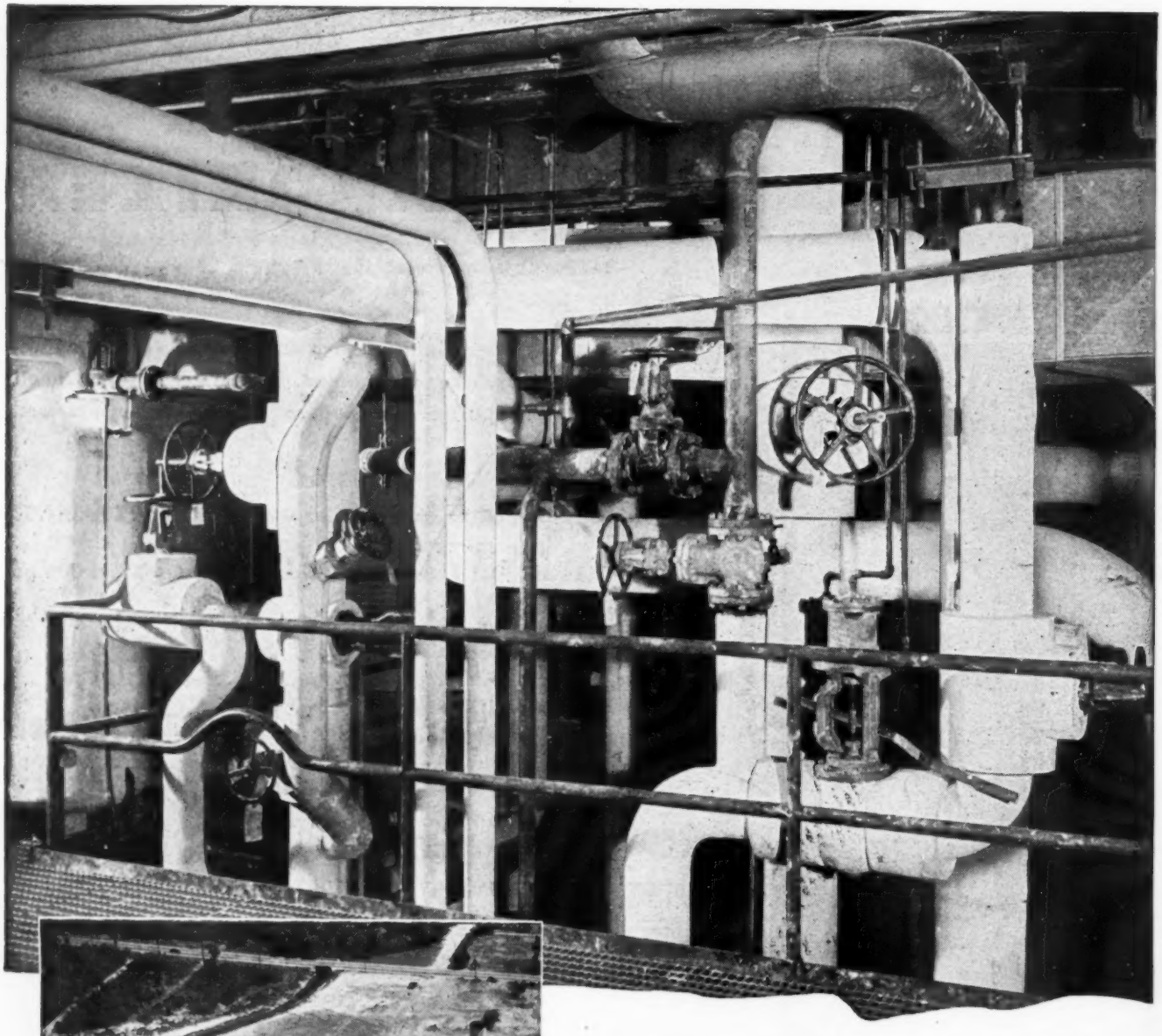
30 Rockefeller Plaza, New York 20, N. Y.



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Navco's high degree of engineering skill and use of the most modern plant and field facilities are your guarantee of a long lasting and trouble-free piping system.

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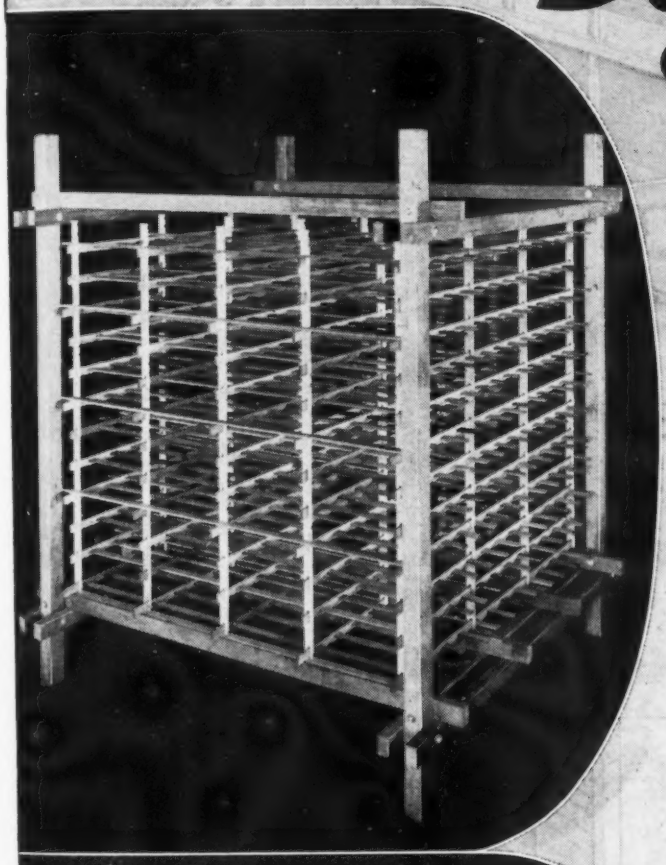
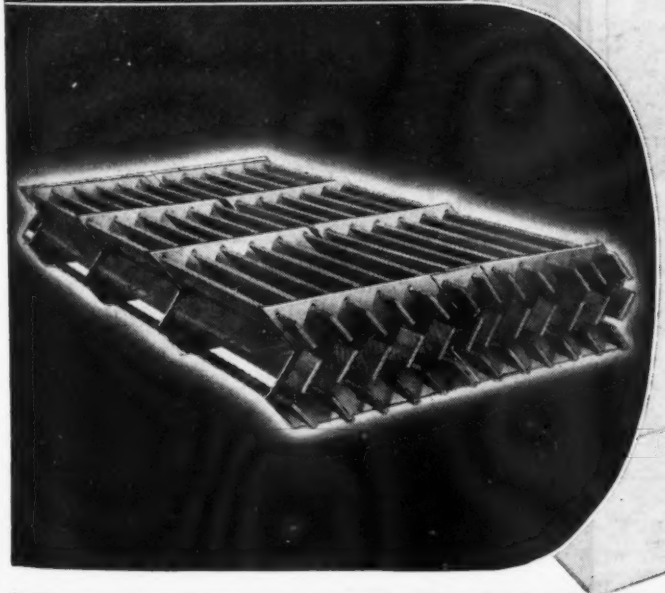
Maximum WETTED SURFACE

can be utilized only by

Double-Flow COOLING TOWERS





How much filling (primary wetted surface) should a cooling tower contain? Enough to thoroughly break up the water into small drops and retard its flow, thus keeping water in contact with air stream for maximum evaporation. The limiting factor is that filling impedes air flow.

Only Marley Double-Flow towers convert this limitation to a distinct operating advantage. Only in Double-Flows can filling be positioned horizontally, as it must be for good break-up and water retardation, yet present the narrow edge of strips to the air stream. The horizontal air stream (exclusively Double-Flow) meets only this edge, then passes across the two widest faces of each strip, thus combining greatest break-up and retardation with desired evaporation.

Marley Nail-less Filling is designed to retain perfect alignment. Rigidly supported at close intervals, it is not permanently fastened at any point. It is free to expand and contract as temperature changes dictate. It cannot warp, twist or sag, allowing solid streams of water to flow through the center of filling sections, leaving the ends dry and inoperative.

In Double-Flows the Triple-Effect Drift Eliminators are positioned to give greater area for air passage than is possible in any other type tower. This also helps overcome the limit to efficient use of filling. Like the filling, Marley eliminators are of nail-less, sagless, long-life design.

MARLEY COOLING TOWERS

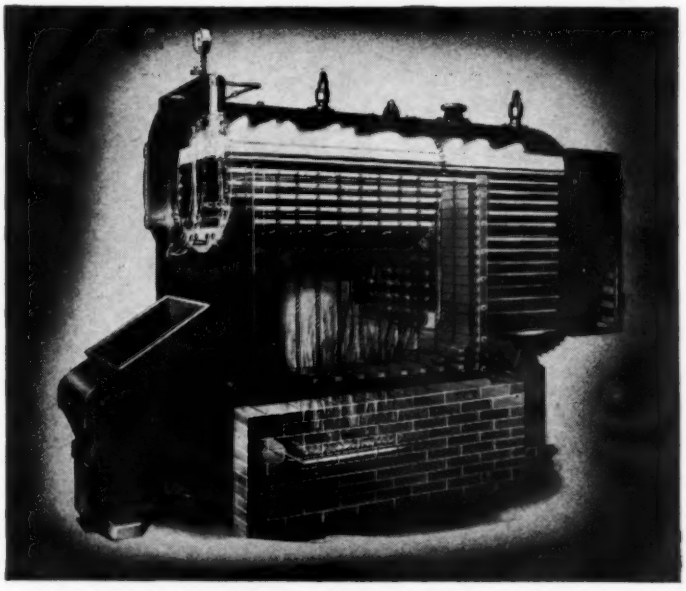
THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

THE ECONOMIC BOILER

THOUSANDS

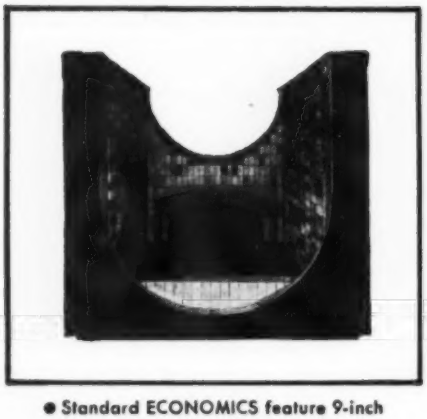
from 20 to 300 hp. in World Service

The Erie City ECONOMIC boiler is the daddy of self-contained boiler-furnace-brick-work units. It is thoroughly standardized and rated according to A.S.M.E. Boiler Code. ECONOMICS are available for 100, 125 or 150 pounds working pressure and are each tested at 50% greater pressure. Each unit is capable of far greater steam output than rated and may be fired by either hand, stoker, gas or oil with only minor setting changes. Write for comprehensive ECONOMIC catalog that describes how rapid steaming, uniform gas velocity, 2000° furnace lining are achieved in this semi-portable boiler.



Erie City ECONOMIC complete with Erie City Underfeed Stoker

Constantly Improved Over 63 Years



● Standard ECONOMICS feature 9-inch refractory lining installed at the factory. This view shows shaking grates in place. For oil, gas or stoker firing we furnish a 13½-inch refractory lined furnace.

● Looking into rear of an ECONOMIC boiler. Rear combustion chamber doors swing open to provide complete access to all tubes. It's easy to keep this boiler at top efficiency.

● Save costly on-the-job boiler assembly; order an Erie City ECONOMIC; it ships as a complete boiler-furnace-brick-work unit ready to set over ash pit and connect to water and steam lines. 20 to 300 hp.

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COMPLETE STEAM POWER PLANT EQUIPMENT

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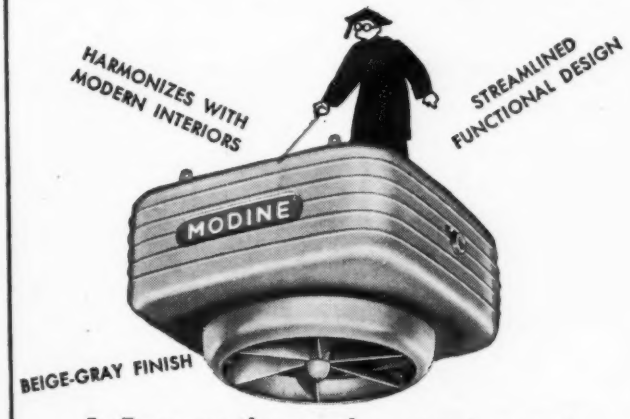
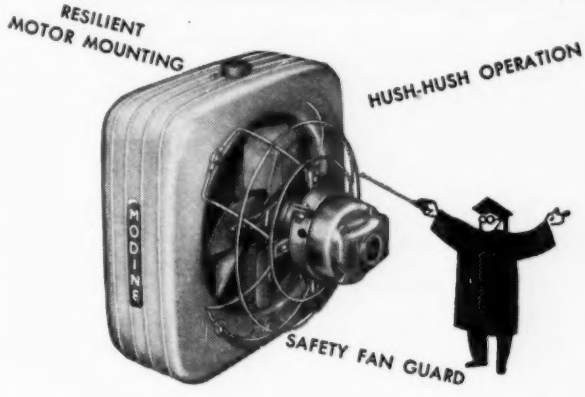
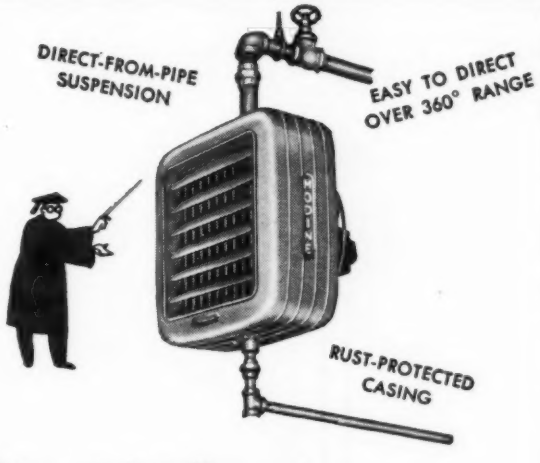
Refresher Course on What's New in Unit Heaters!



1. *Easy* on the eyes! Functionally designed, streamlined Modines give your interiors a look of beauty and distinction! Yet you pay no more for Modine Unit Heaters in your plant, store or office.



2. *Easy* on the ears! Modine scientifically designed venturi inlet, velocity generator and adjustable curved deflector blades give you uniform, quiet heat delivery, positive penetration of cold air strata near floors.



3. *Easy* to install! Forget about expensive supports, extra labor costs with Modine. Patented center supply and return connections mean horizontal unit can be safely suspended directly from supply line.

4. *Easy* to apply! Modine's wide line gives you the right unit for your needs: 1) Horizontal Type for general applications. 2) Vertical Type for overhead use. 3) Power Throw Type for high velocities.

P. S. No Wonder Modine Quality is Hard to Beat!

First in design . . . first in performance — that's Modine Unit Heaters, *the* quality unit heaters for your needs. If you're building or modernizing a plant, store or office, specify Modine. For complete information, call the Modine representative listed in the "Where-to-Buy-it" section of your phone book. Or send in coupon at right.

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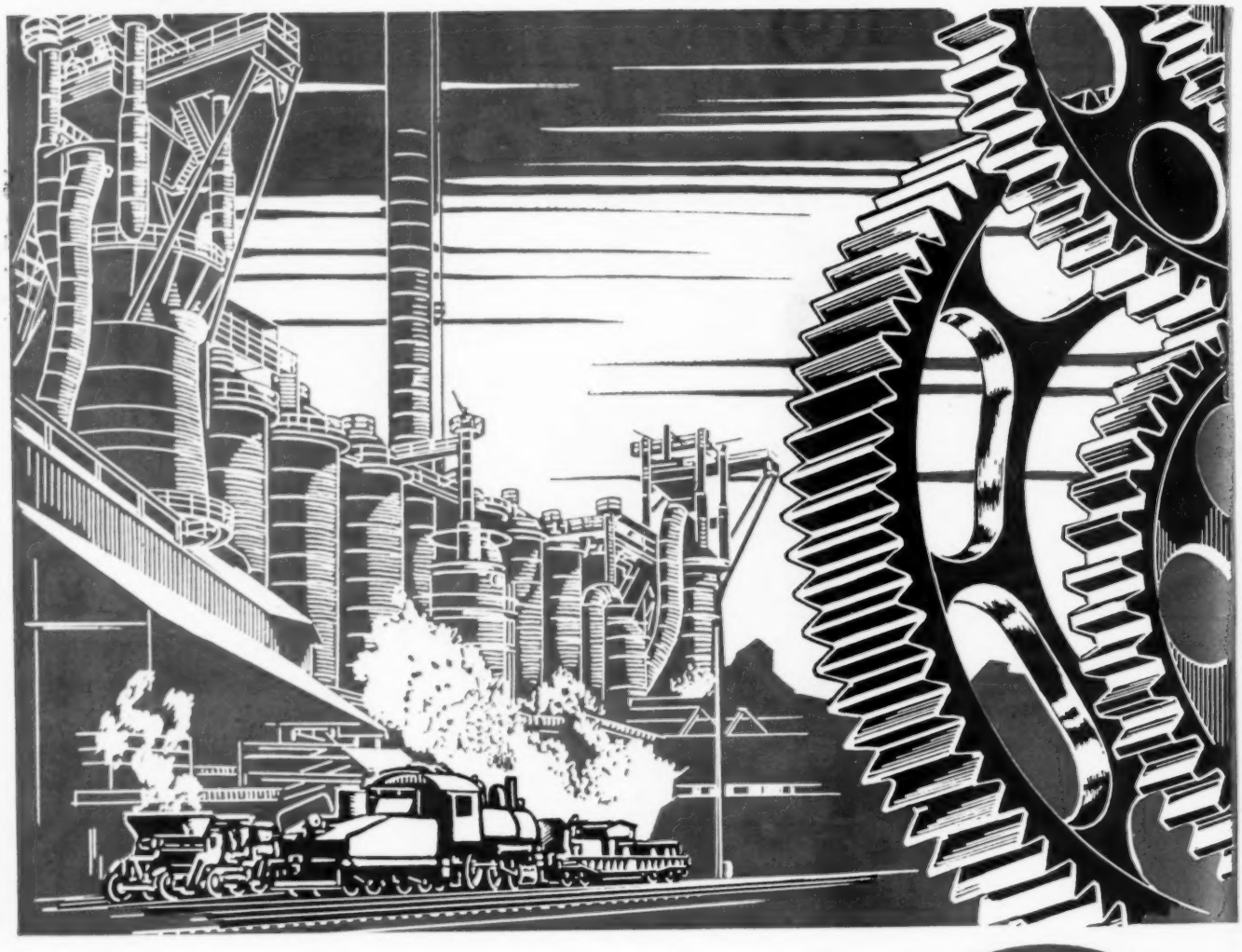

Tycol Engineered Lubrication performs better because:

. . . *Tycol Engineered Lubrication* is scientifically engineered to meet every service condition in modern industry, no matter how extreme or unusual.

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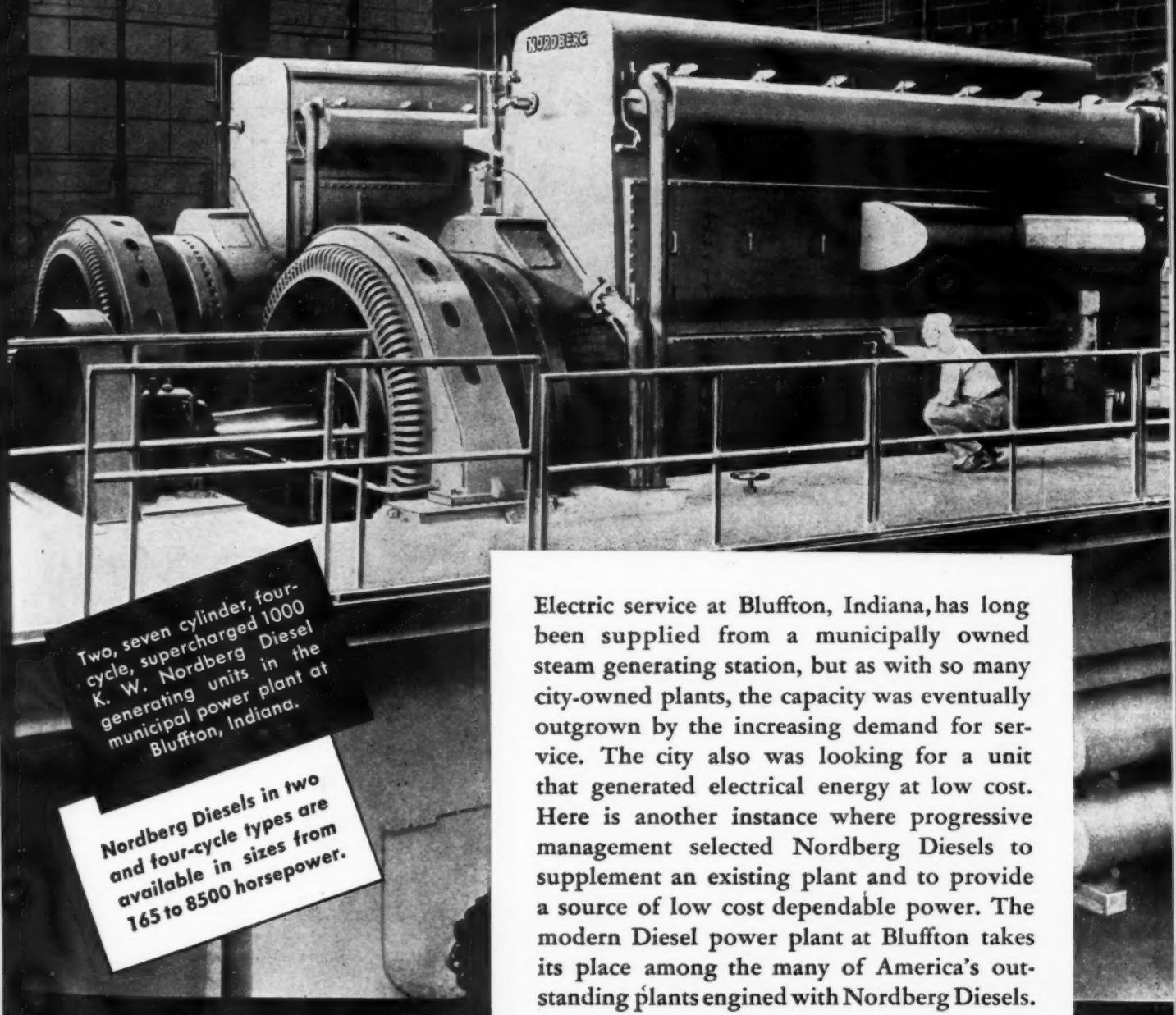
BLUFFTON'S
Municipal Power

Supplied by NORDBERG DIESELS



Two, seven cylinder, four-cycle, supercharged 1000 K. W. Nordberg Diesel generating units in the municipal power plant at Bluffton, Indiana.

Nordberg Diesels in two and four-cycle types are available in sizes from 165 to 8500 horsepower.

Electric service at Bluffton, Indiana, has long been supplied from a municipally owned steam generating station, but as with so many city-owned plants, the capacity was eventually outgrown by the increasing demand for service. The city also was looking for a unit that generated electrical energy at low cost. Here is another instance where progressive management selected Nordberg Diesels to supplement an existing plant and to provide a source of low cost dependable power. The modern Diesel power plant at Bluffton takes its place among the many of America's outstanding plants engined with Nordberg Diesels.

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QUAKER PRE-TESTED BELTS, HOSE, PACKINGS

. . . get a long lease on life

. . . give plant economy a lift

Each batch of rubber used in making Quaker products is pre-tested for toughness, adhesion, resistance to aging. Shown above, samples of rubber compounds are being subjected to the oxygen bomb test—a miniature "torture chamber" that crams the effects of two years of severe operation into four grueling days. Performance-proved assurance that each rubber compound "can take it" is essential before being built into Quaker belting, hose, packings.

Check the panel on the right and see how Quaker pre-tested products can help keep operating costs low . . . output up, in your company. Remember—Quaker has been supplying quality rubber products to Industry for 63 years . . . pre-tested and proved for peak performance.

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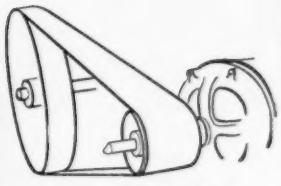
WHAT QUAKER Pre-Tested Products mean to the Power Field

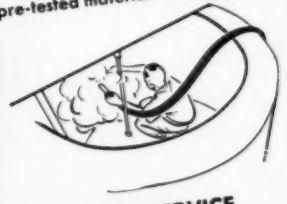


STEADY GRIP . . . LESS SLIP

Quaker V-belts and flat belting are pre-tested to provide plenty of grip, plenty of pull for more power. Pre-tested rubber stays flexible, withstands aging and abrasion.

TIGHT-SEALING OPERATION

Quaker pre-tested packings for all purposes keep pressure in . . . stop leaks on valve stems, piston rods, flanges. Made of pre-tested materials for long life.



LONG SERVICE AT HIGH PRESSURE

Quaker hose provides low-cost handling of steam, air, liquids, volatiles. Pre-tested rubber remains pliable, flexes easily, combats breakdown.

●

ENGINEERING SERVICE

When belting, hose, and packing problems bog down efficiency in your plant, call your Quaker Distributor for a quick solution.

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custom made for every industrial use

SANTOSITE . . . controls oxygen corrosion

Santosite eliminates all traces of residual oxygen in boiler feed water. It removes the dissolved oxygen by combining with it to form sodium sulfate, which is water soluble under boiler conditions — and therefore does not contribute to the formation of sludge.

By maintaining a residual of 30 parts of Santosite to 1,000,000 parts of water in the system, boilers and tubes are protected against the occasional appearance of oxygen due to unexpected overloads on the system or leaks in condensers, pump packing glands and vacuum-return heating systems. No test for dissolved oxygen is required.

For detailed technical information, fill in the coupon below, and you will receive a copy of Monsanto Technical Bulletin No. O-26, "Santosite for Removing Oxygen from Boiler Feed Water." *Santosite: Reg. U. S. Pat. Off.*

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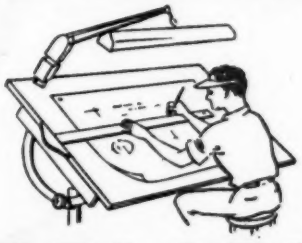

...in VALVE MANUFACTURE

The architect who designs a good industrial plant has to have qualifications different from the architect who can design a "gem of a home." This is true also of valve manufacture. The best valves for resistance to corrosion and contamination in pipe lines are made by the valve manufacturer who *specializes* in valves of corrosion-resistant alloys. This is the case with Aloyco. We handle nothing but stainless steels and related corrosion-resistant alloys—and we make nothing but valves. Having maintained this high degree of specialization ever since we first started in business, we have acquired a skill which assures the very best in corrosion-resistant valves for our customers.

In our organization are combined a knowledge of the chemistry of corrosion and contamination, the metallurgy of corrosion-resistant alloys and the engineering and manufacturing experience necessary to obtain best results in the fabrication of these materials and the production of valves that are mechanically correct. Consult us on your requirements.

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Series 600
Gear Operated
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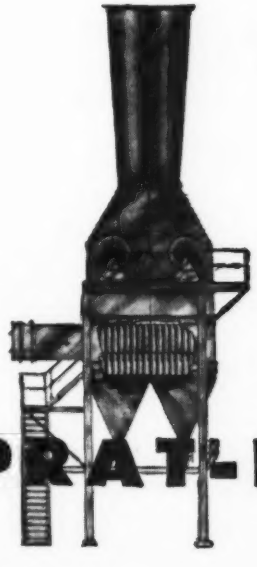
COORDINATION

Prerequisite to Induced Draft Efficiency



Coordination of the components is as important to the efficiency of Induced Draft Equipment as it is to the smooth harmony of a ballet.

Beside the disadvantage of higher cost when installed separately—unit by unit—the non-integrated breeching, I.D. Fan and Stack, in many cases, operate at sub-standard efficiency due to lack of over-all unified engineering.

Prat-Daniel research has evolved an induced draft system that eliminates this problem . . . provides the absolute ultimate in fuel efficiency.

Result—the well-known Thermix Fan Stack! Inlet Breeching, Fan and Stack combined in a single, integrated draft-producing unit that is unbeatable for high level performance.

From boiler outlet to atmosphere, depend on Thermix Fan Stacks to maintain predetermined, constant draft with full efficiency for your boiler.

Our project engineers will be glad to show you the advantages of Thermix equipment. Write for a complete catalog on your company letterhead. *All inquiries should be directed to*

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PRAT-DANIEL CORPORATION

Manufacturers of Thermix Equipment

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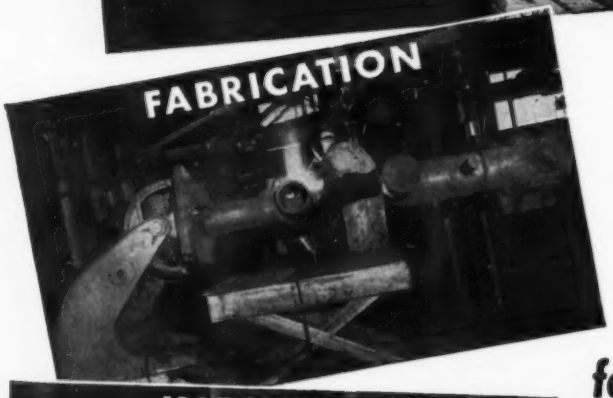

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for WORLD FAMOUS POWER PLANTS

In every major industrial area there are great power plants having piping systems whose efficient operation was "built in" by expert P. P. & E. prefabrication.

Prefabrication by Pittsburgh Piping and Equipment Company starts with the blueprint—materials are selected on the basis of conditions to be met, and completely erected by skilled craftsmen.

When you place your *complete* job in the hands of P. P. & E.—you utilize to the utmost extent the knowledge we have accumulated through almost half a century of producing piping systems for the world's greatest power plants.

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Dowell's industrial engineers are thoroughly experienced in successful chemical cleaning. They are supported by the full research and technical resources of Dowell's own laboratories.

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Marsh alone has the "Recalibrator" — quickest and best way to correct a gauge that has been knocked out of adjustment by improper handling.

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There are new facilities here for carrying out the many extra steps that have contributed so much extra value to all Marsh instruments—new facilities for the testing of materials, for the gauging of component parts, for the final testing of every Marsh product.

Yes, the finest of pressure gauges are being made still better in the new Marsh plant. Insist on Marsh accuracy and stamina when you select pressure gauges—or equipment requiring gauges.

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It takes a pressure gauge to tell you what's going on inside that boiler, tank, compressor, pump or similar equipment — and a good one to tell it right. Those who know pressure gauges best, insist on Marsh instruments . . . well confirmed by the preference accorded Marsh gauges as original equipment by manufacturers of boilers, hydraulic machinery, compressors, refrigeration equipment, food processing machinery, and equipment for the petroleum industry.

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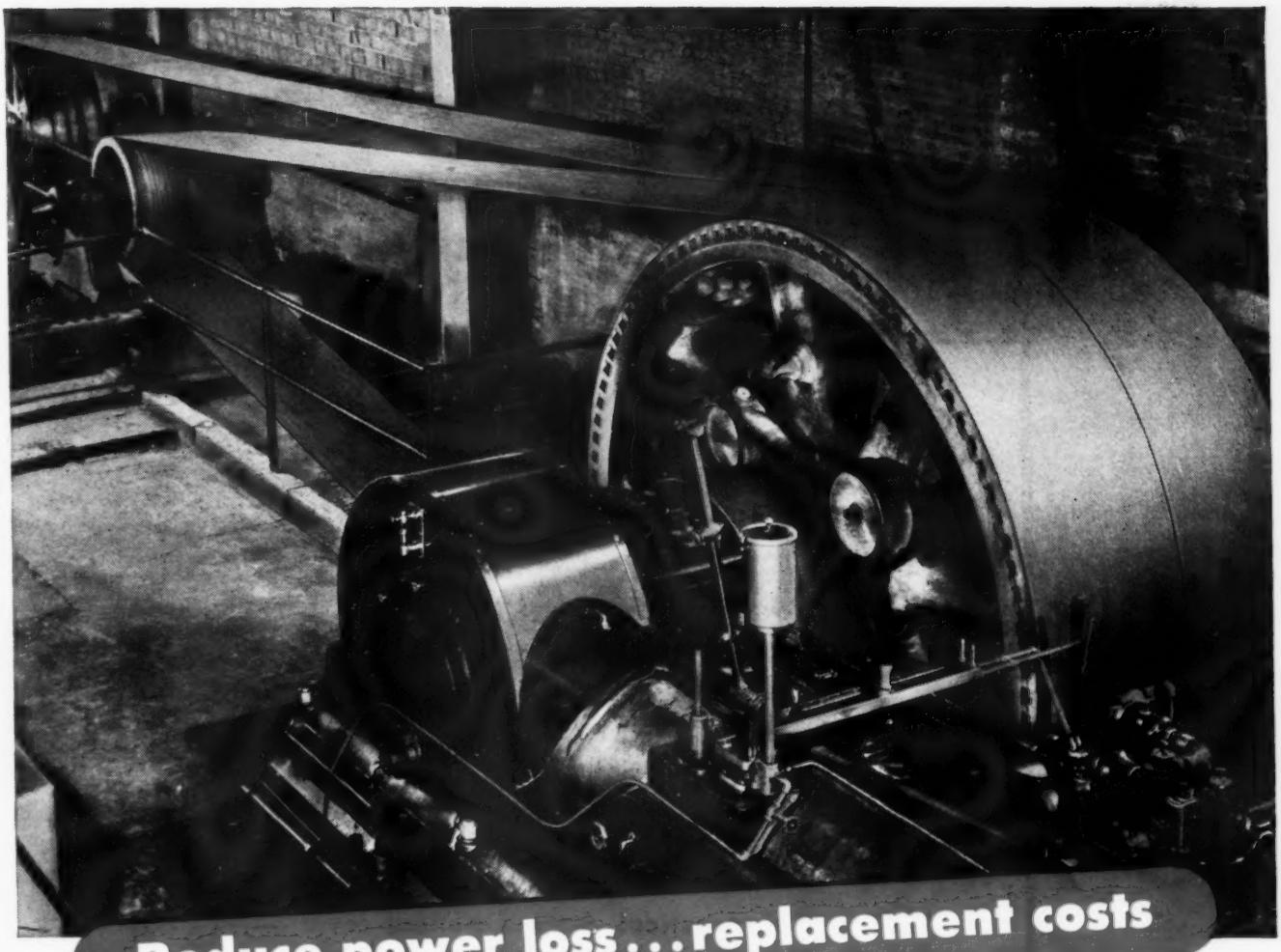

Reduce power loss... replacement costs

Yes, you *save* on power costs when you use Hewitt's Monarch Amber Transmission Belting.

You won't waste power through belt slippage. And you can depend on the belt for full power even when operating at peak capacity.

This famous, extra high quality belting is made by Hewitt to assure maximum power delivery from drive pulley to driven pulley. You will find that it is especially adaptable for your power transmission operations where severe flexing—due to small pulleys, high speeds, and short centers—is encountered.

Monarch straight-edge Amber Transmission Belting is made of only premium-grade, hard (silver) duck. All plies are embedded—completely insulated with highest quality pure gum rubber compounds—to give you the advantages of greater freedom from stretch. It resists moisture, mildew, grit.

For maximum performance use Monarch Amber Transmission Belting wherever there are heavy shock loads or abuse conditions—in pulp and paper mills, saw mills, mines, stone crushing plants, oil fields, quarries, and other severe transmission operations.

Phone your Hewitt distributor for further details on this unusual new belting. He's listed in the yellow pages of your telephone directory. Or write Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, N. Y. No obligation, of course!

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Transmission Belting

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2. All plies straight-laid under uniform tension to insure even stresses throughout the belting.

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4. No folds, no seams—due to straight-edge construction. Doubles traction life—makes possible use of either side.

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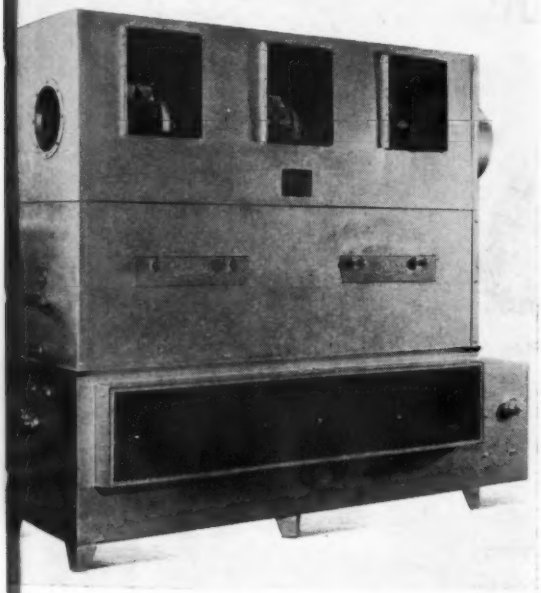

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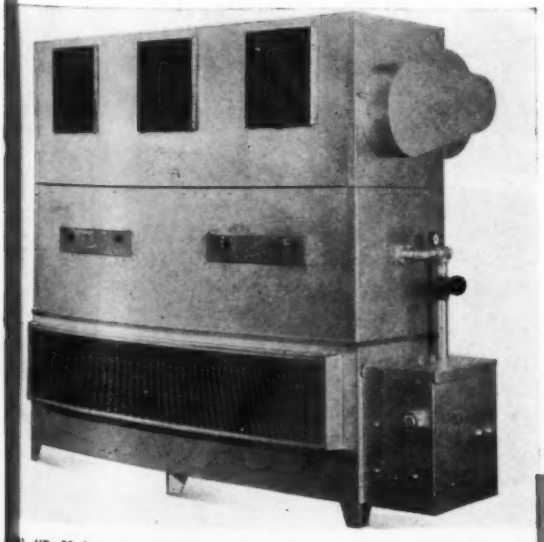

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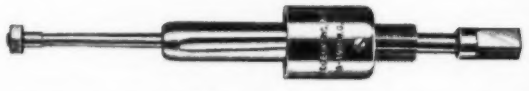

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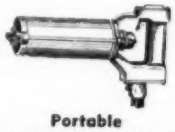

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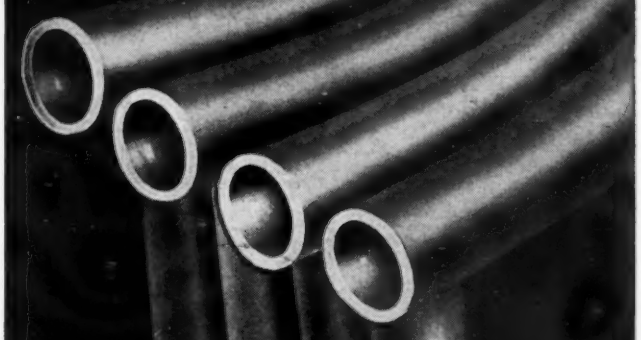

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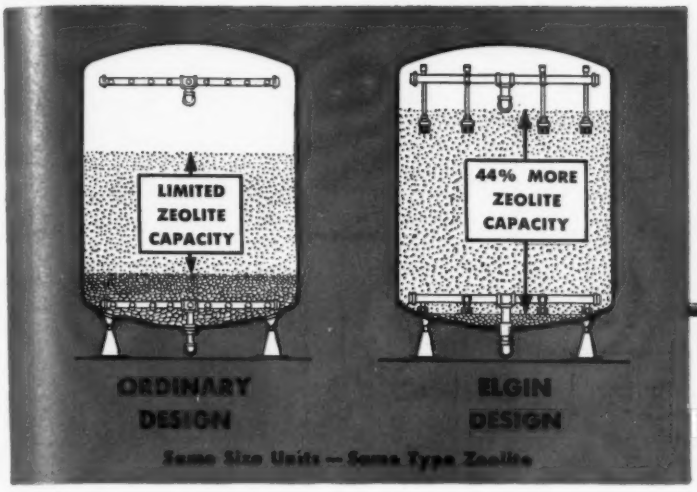

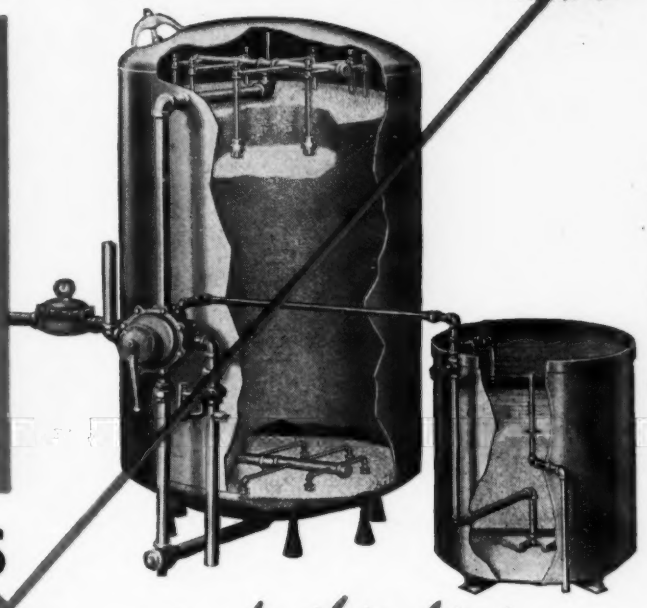

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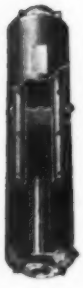

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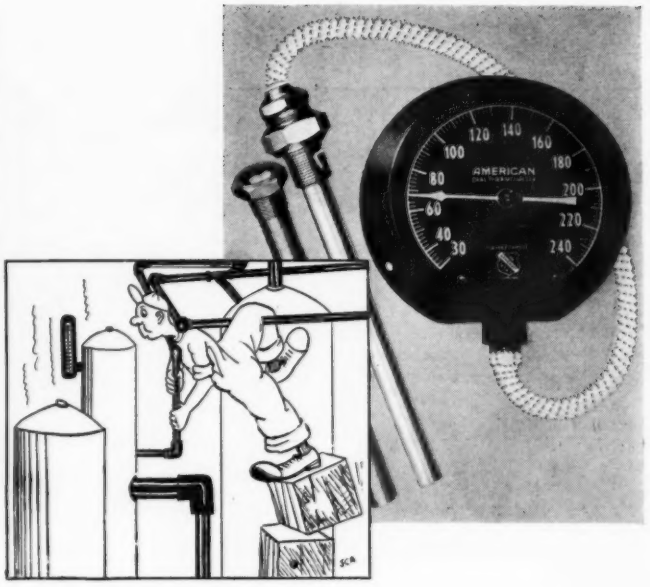

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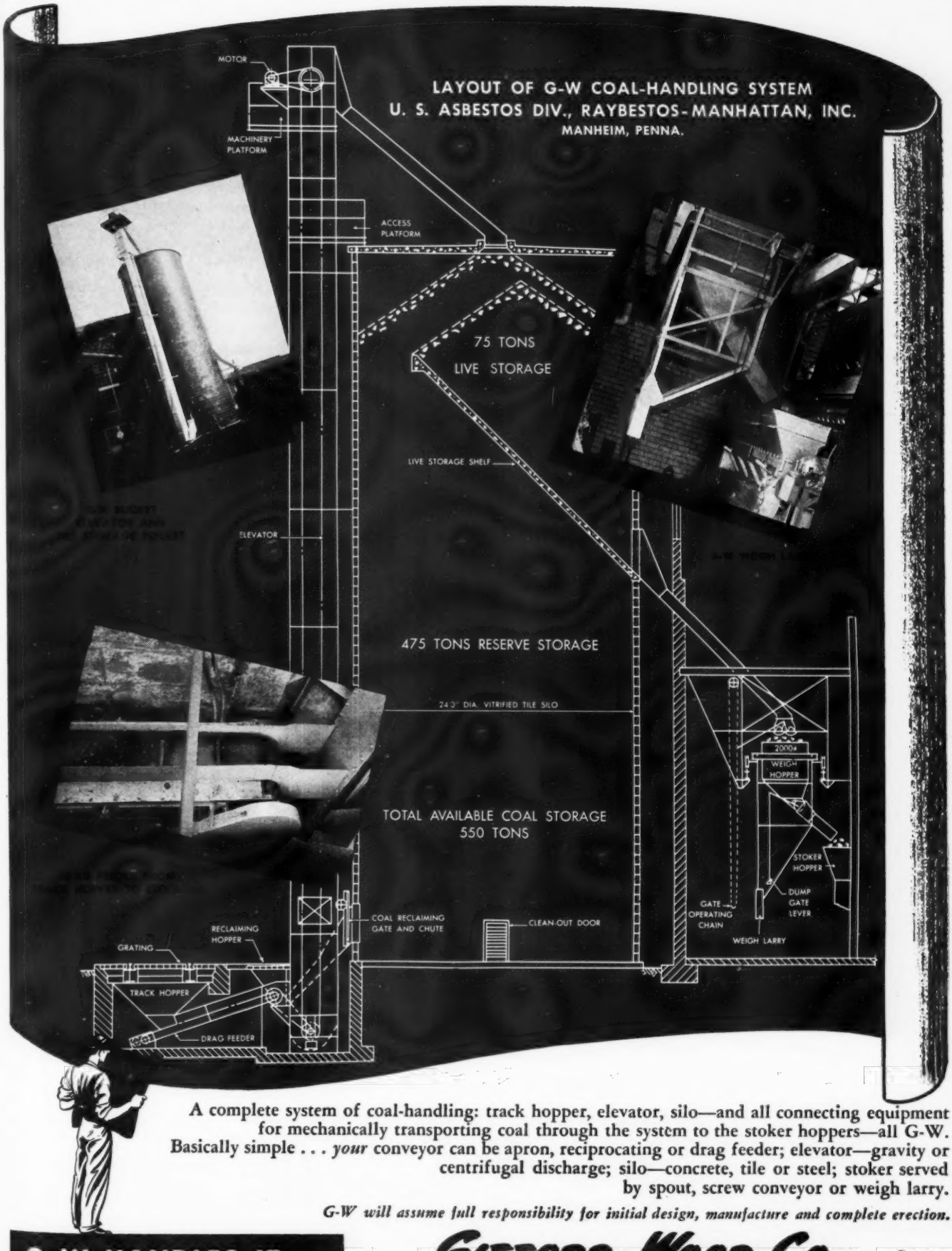

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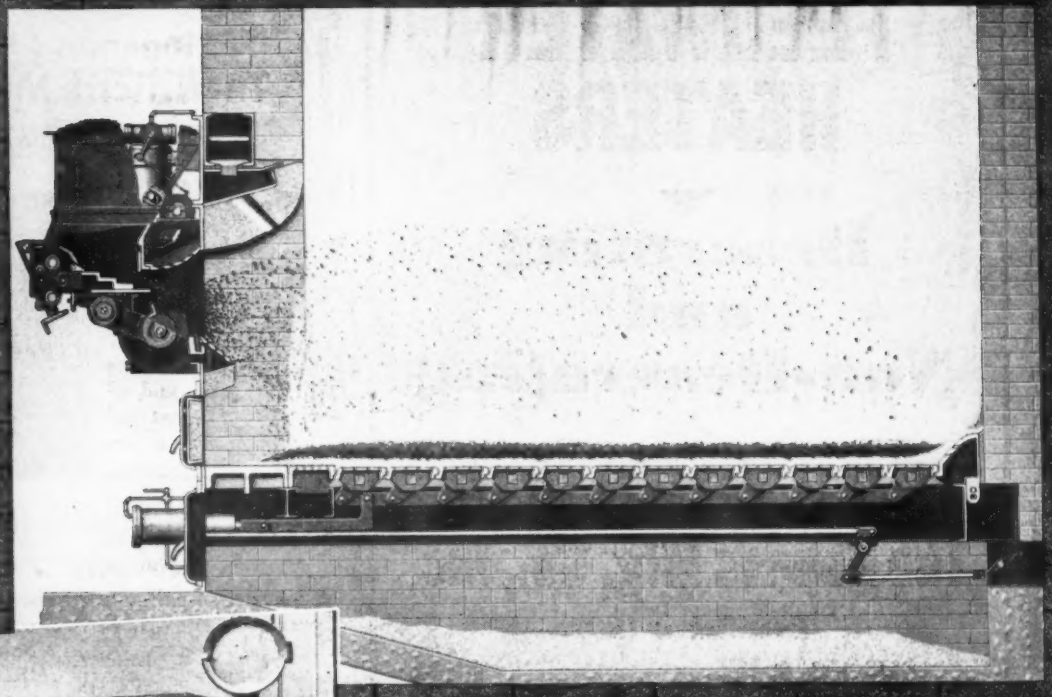

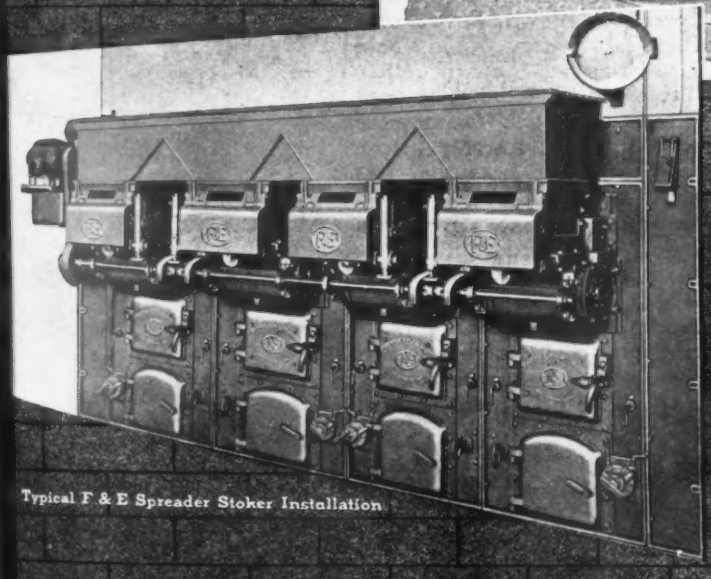

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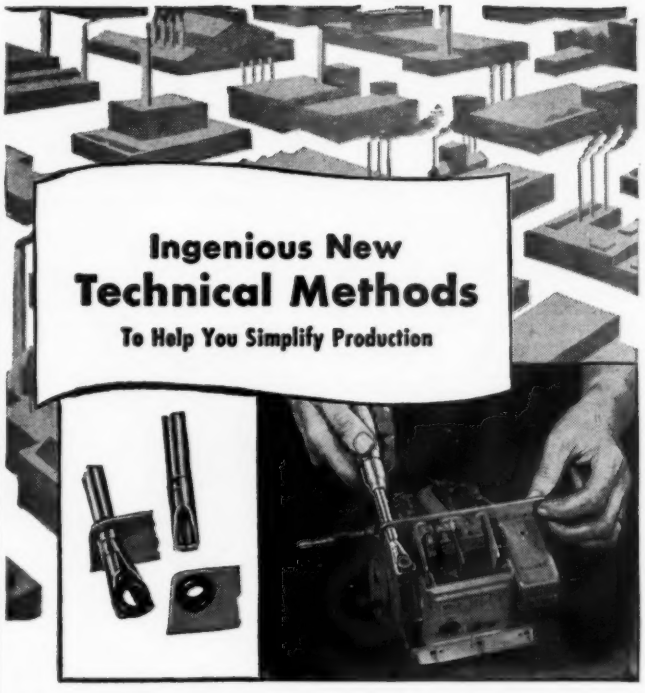

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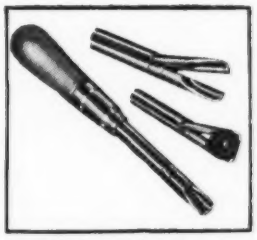

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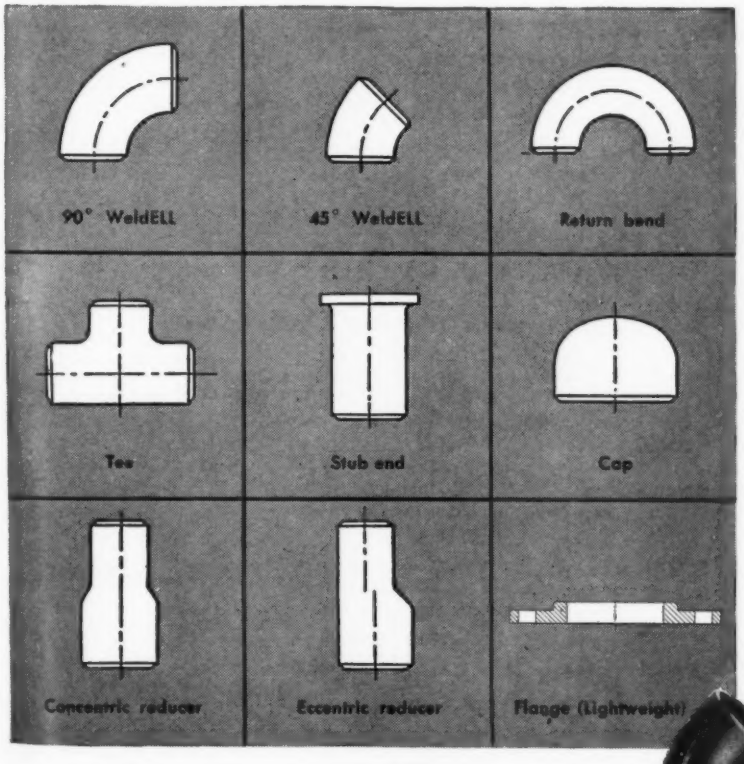

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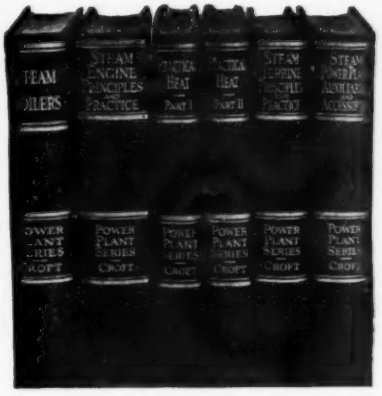

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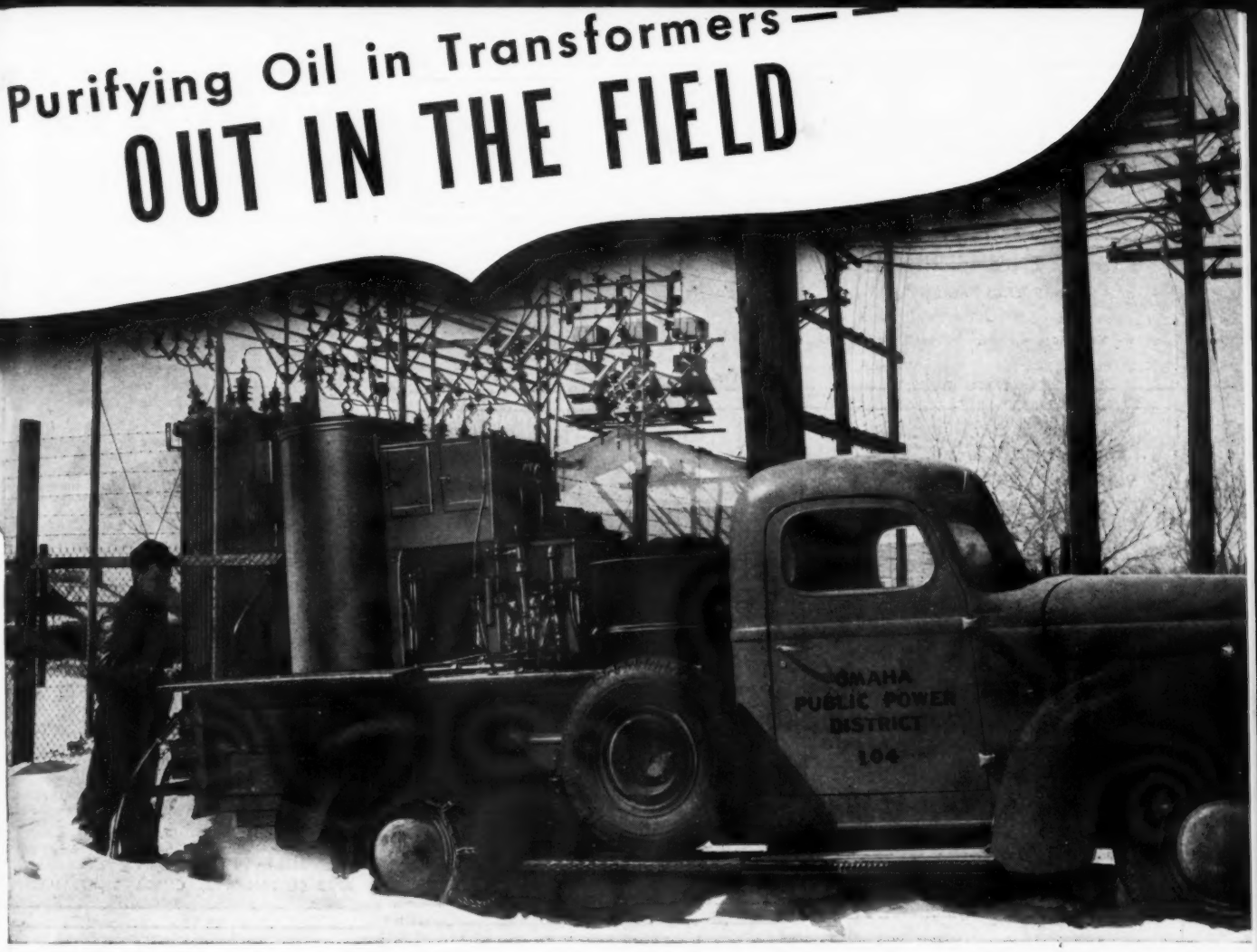

Honan-Crane "R" Type Purifier mounted on pickup truck purifying oil in a transformer at substation located at 16th Avenue and 11th Street, Council Bluffs, Iowa. Picture taken on coldest day of year, —16°, March 11, 1948.

● Omaha Public Power District uses a HONAN-CRANE "R" TYPE OIL PURIFIER to maintain the oil in over 1,000 transformers in their 300 substations. These transformers are mostly 300 to 600 gallon capacity and some of them are located 55 miles from the shop in Omaha. Consider these advantages:

1. Purifier is brought to transformer and oil is purified without shutting off transformer.
2. Circulation of purified oil through the transformer cleans up any deposits that may have formed on the coils or case.
3. Proper schedule of purification keeps oil free from a buildup of contamination and guards against oil and transformer failure.
4. This purifier has been in operation since 1944 and no oil has been discarded since the purifier has been in use.

A second Honan-Crane "R" Type Purifier was purchased by Omaha Public Power District in 1946 and is used at the power plant to purify oil in several large banks of transformers outside the plant, about 200 small units inside the plant including voltage regulators, switches, reactors, etc., and the turbine oils used in the steam turbines.

A HONAN-CRANE PURIFIER IS THE MOST EFFECTIVE AND ECONOMICAL MEANS OF MAINTAINING EITHER INSULATING OR TURBINE OILS FREE FROM CONTAMINATION

PLEASE SEND COMPLETE INFORMATION ON

- ☐ Honan-Crane "R" Type Purifier for Insulating Oils
- ☐ Honan-Crane Purifier for Turbine Oils
- ☐ Engineering Bulletin on Purifying Insulating Oils
- ☐ Engineering Bulletin on Purifying Turbine Oils
- ☐ Please have a Honan-Crane Sales Engineer call.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

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1200 SIXTH STREET, LEBANON, INDIANA

A SUBSIDIARY OF
HOUDAILLE-HERSHEY
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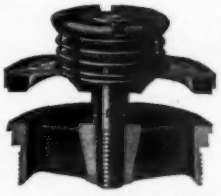
Featuring additional products and specialties for power plants



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Standard In
RAILROADS, MINES, WATER WORKS INDUSTRIALS

• They increase efficiency, capacity, economy—decrease slippage, leakage, fuel consumption—will not sink in seat ports, warp, break, curl, or ride seat bridges. For hot or cold water service . . . thoroughly dependable.

BIRCH MANUFACTURING CO.
1521 Sedgwick St., Chicago, Ill.

HILL PUMP VALVES

SINCE 1909

• The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate.

Write for Bulletin

HILL PUMP VALVE CO.
2728 ELSTON AVE., CHICAGO 47, ILL.

TO manufacturers of equipment and those offering special services to the power industry, this section offers an inexpensive means of keeping products or services regularly before your potential customers—The readers of POWER. The small spaces available here provide opportunity for you to be represented in every issue at low cost. Can we serve you?

SAVE *up to* 40%

If you make or use boilers insulate with MONO-BLOCK!

Records show it! Today's buyers know it! In insulating boilers and processing equipment, you can save up to 40%—using this one-block insulation that serves the full temperature range.

Savings in Material—Because Mono-Block is effective up to 1700°F, you eliminate the need for two types of block—save up to 40% in material alone.

Savings in Labor—Only one block to apply instead of handling a combination of blocks. B-H Mono-Block is light and resilient, cuts readily and fits snugly over rivet heads and other irregular surfaces.

Savings in Heat—B-H Mono-Block stops heat loss *with maximum efficiency*—because it's felted of long fibre *black* Rockwool. For example, conductivity of one inch thickness at 1000°F is only 0.64 btu's per square foot per hour. Low alkalinity insures stability even under severe conditions.

Isn't that worth investigating? As a first step, send the coupon for a sample and descriptive literature.

Baldwin-Hill

Specialists in Thermal Insulation

BH NO. 1 CEMENT

BH BLANKETS

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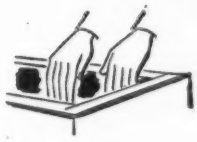

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BALDWIN-HILL COMPANY
731 Breunig Avenue, Trenton 2, New Jersey

Send free sample of Mono-Block and 24-page data book "Industrial Insulations."

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POSITION.....

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ADDRESS.....

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POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.
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BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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The advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

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NEW ADVERTISEMENTS received by May 10th will appear in the June issue, subject to limitation of space available

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WANTED IN CALIFORNIA

Project Managers—Project Engineers
Design Engineers—Estimators
Superintendents

For design and construction of Chemical Plants, Oil Refineries, Steam Power Plants and Industrial Process Plants.

Fully qualified men only. Please give full details, experience, age, availability, and past salaries. Attach photograph. All replies confidential.

P-4498, Power,
68 Post Street, San Francisco 4, Cal.

Management Position open for graduate

MECHANICAL ENGINEER

35 to 40 years of age with experience in practical process Thermodynamics preferably Heat Exchangers and Cooling Towers

Excellent opportunity in
WELL ESTABLISHED ENGINEERING FIRM
In midwestern city.
Salary open. Respond promptly.
P-4564, Power
520 North Michigan Ave., Chicago 11, Ill.

STRUCTURAL ENGINEERS

New York engineering organization specializing in design and construction of power plants and industrial structures desires to employ engineers thoroughly experienced in all phases of structural design, correlated with architectural design: planning, assigning of work, writing of specifications, requisitioning of materials and placing of orders. Applicant should be at least 40 years old, with about 15 years general field and office structural experience. Please submit resumes.

P-4135, Power
330 West 42nd Street, New York 18, N. Y.

Mechanical Design Engineer

With Administrative Experience in the Design of Steam Electric Stations
Preferably Between 35 and 45 Years of Age
LARGE EASTERN UTILITY
All Replies Strictly Confidential

P-3323, Power
330 West 42nd Street, New York 18, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED — ENGINEERING graduate with some power plant experience to train for position as assistant boiler house superintendent in large industrial plant. P-4270, Power.

WANTED: RESIDENT Engineers and Inspectors for power plant and transmission line construction. Work in Iowa and immediate vicinity. Stanley Engineering Company, Hershey Building, Muscatine, Iowa.

WANTED — ENGINEERS — Excellent opportunity for mechanical engineers and engineering draftsmen with large, expanding southern industry, for plant layout, machine design and mechanical and process development work. Experience in pulp, paper or allied industry desirable but not essential. State education, experience, age, salary, and availability. All details confidential. P-4395, Power.

GRADUATED MECHANICAL Engineer wanted; experienced in the operation of modern up to date boiler installations. Will be responsible for operation of Boiler and Engine room on economical basis. Permanent position and good opportunity for advancement with well established firm operating in Southern Tier Region of New York state. Please state in detail: education, experience, qualifications, and personal history. P-4399, Power.

WANTED—ASSISTANT to Chief Engineer in Industrial Plant located in New Jersey about 45 miles from New York City. Experienced in the operation and maintenance of steam power plant, engines and factory equipment. State education, experience, references, personal data, salary expected and when available. P-4383, Power.

ONE OF the larger independent oil companies requires the services of shift engineers capable of supervising refinery utilities including generation of steam at high pressure, water treatment and water cooling and conditioning. Location southwest. Several years' college training or equivalent I.C.S. required. Applicant should be under forty years of age and should furnish outline of education, experience, previous employers, salaries received, and photograph. P.-4441, Power.

WANTED—LARGE Industry with expansion program has opening for a steam and electrical engineer, capable of design and installation of steam plant and electrical equipment with opportunity as plant engineer after construction period. Give age, education and experience in first letter with salary desired. P-4571, Power.

WANTED: ELECTRICAL Engineer or Mechanical Engineer with electrical experience in plant layouts for a specific job of 3-6 months' duration. A permanent connection with a growing Wisconsin paper mill could result. Write P-4572, Power.

WANTED: WATCH Engineer for power plant of large industrial plant. College degree is preferable but may be offset by adequate experience, particularly in the operation and maintenance of large coal burning boilers. P-4679, Power.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (38 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

(Continued on page 259)

WANTED

POWER PLANT SUPERINTENDENT

Large public utility, building new power plant with initial capacity of 132,000 KW. needs immediately, high grade operating man fully experienced in modern power plant operation using high pressure steam, (1250 lbs. per sq. in.) and pulverized coal. Permanent opportunity for thoroughly qualified man to take complete charge of operation of plant, maintenance, handling of all labor, etc. Send full details of experience, in confidence, to

P-4289, Power,
330 West 42nd Street, New York 18, N. Y.

DISTRICT SALES ENGINEERS

STOKERS

SPREADER TYPE UNDERFEED TYPE

Outstanding and well known line of stokers—equipment now in great demand—unusual opportunity to realize large earnings.

P-3811, Power
330 West 42nd Street, New York 18, N. Y.

WANTED

Mechanical Engineer

Two machine mill manufacturing high grade folding boxboards requires plant engineer with industry experience. Give complete details as to qualifications, salary expected, and date available.

P-4477, Power,
330 West 42nd Street, New York 18, N. Y.

WANTED

COMBUSTION SALES ENGINEER

to sell COKAL HAND STOKERS. Standard of the World for 30 years. Burns *all* Grades and Sizes of Bituminous Coal. For Active and for Standby Plants. A Small Investment—A Large Return in Security. Address—Sales Manager, P.O. Box 127, Evansville, Ind.

WANTED MANUFACTURER'S REPRESENTATIVE

to contact coal-burning industrial institutions to distribute Today's Coal Bill Reducer (for high pressure boilers) which pays for itself quickly. Sales and combustion engineering experience desirable.
Address — P. O. Box 1367 — Chicago, Ill.

WANTED

SALES REPRESENTATIVES

Engineers or mechanics familiar with pump valves in steam pumps to call on Chief Operating Engineers. No technical training or investment required. Liberal commission. State age, experience, lines represented and territory.

BIRCH MANUFACTURING CO.
1323 Sedgwick St. Chicago 10, Ill.

AGENTS WANTED

SHEAR-KLEAN Grate Engineers have open territory for live wire Sales Engineers on famous SHEAR-KLEAN Grates. Suitable for all types of boilers. Write—

P. O. Box 656, Evansville, Indiana.

EMPLOYMENT SERVICES

(Continued from page 258)

SALARIED PERSONNEL, $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

ENGINEERS: LARGE college offers $3,000 approximately half time teaching-studying. Positions of all ranks for masters $4,000-$10,000. Cline Teachers Agency, East Lansing, Mich.

POSITIONS WANTED

M.A. (ENGINEERING) Cambridge University, England. Seeking responsible position. Specialized in all forms boiler engineering and has 3 years post graduate training in all departments of mechanical engineering. PW-4106, Power.

ELECTRICAL ENGINEER, 13 years supervision, operation, maintenance, design and construction of steam and diesel power plants. Now employed Chief Electrical Engineer. Seven years District Manager for Public Utilities. Age 40, married. Registered engineer. Prefer locating in South or Middle West with utility or large industrial plant. PW-4072, Power.

POWER PLANT Supervisor. Electrical-Mechanical background. Familiar with boiler and electrical generating 10,000 K.W. plants, refrigeration, heating, air compression, water treating. First Class Ohio License. Member N.A.P.E. Experience and mature judgment only found at age 50. May availability. PW-4352, Power.

CHIEF ENGINEER on Centrifugal Pumps, with over 30 years exclusively in this engineering field desires connection with opportunity to modernize or expand present line, or to develop top-notch highly standardized units for manufacturer of associated equipment. Opportunity for machinery mfr. wanting new product. Will organize and execute entire program from design to tests, on small close-coupled to large or medium single or multi-stage split casin types. Eastern location preferred, others acceptable and considered. PW-4592, Power.

YOUNG STEAM Power Engineer desires permanent position with a growing and progressive concern. Willing to understudy, or take additional specialized training. Available on short notice. Steam-Combustion Engineering graduate I.C.S., State licensed Steam Engineer, Ohio, Maryland. Nine years practical experience plant operation, three of these in supervisory capacity. Present position offers no further future for advancement. 28 years of age, married, Navy veteran. Minimum salary $350 per month. PW-4594, Power.

AVAILABLE—ENGINEER

with ME and EE degrees, age 44, with wide experience in the design and operation and maintenance of heating, ventilating, air conditioning, plumbing and electrical work particularly in large bakeries wishes to locate in far west or south with small but progressive organization. Either for maintenance or design work. Reply to:

PW-4501, Power
520 North Michigan Ave., Chicago 11, Ill.

Manufacturers Representative

Familiar in wide field of Factory and Jobbers equipment. Desires immediate connection with company wishing to open up Southeastern territory. Have late model car, best bank and personal references. Experience 15 years in the north, 10 years in the south. Wide acquaintance, age 45.

RA-4525, Power
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DISMANTLING?

Boilers, Engines, Generators, Etc. dismantled & removed. Complete Plants purchased, dismantled and removed anywhere in the East.

Men — Tools — Insurance
30 yrs. experience.

"We can dismantle anything made of metal"

G. M. LINDER CO.
Plant Dismantlers & Contractors
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(day or night)

FOR SALE—EXCELLENT

GENERATING SET

100 K. W.

for operating on illuminating gas, natural gas or gasoline

GENERATOR—480 volts, 3 phase, 60 cycles, 125 KVA 80% P. F. Allis Chalmers make, with direct connected exciter.
ENGINE—Sterling 6 cylinder, 5¾" bore x 6¾" stroke, dual valve in head, 1200 R.P.M. Electric start.
SWITCHBOARD—with voltage regulator, oil circuit breaker, kilowatt meter, instruments.

HUGH A. BROWN, *Sales Agent*
235-39 36th Ave., Douglaston, N. Y.

FOR SALE

COAL STOKERS

2 unused Fredericks Coal Stokers for 400 HP Boilers. Hydraulic; ram type; underfeed; capacity 2500#/Hr., 64 sq. ft. grate area, complete with controls. Equipment purchased for assurance against coal shortage 1945. Substantial sacrifice. Contact G. Tacke,

BURROUGHS WELLCOME & CO. (U.S.A.) Inc.,
Tuckahoe, New York

FOR SALE

BOILERS

Two used 150-H.P. H.R.T. suspended type 150-lb. pressure boilers, 72 inches by 20 feet. In perfect shape. Code construction with combination gas and oil burners.

EARL MELIA, *Chief Engineer*
Boys Town, Nebr.

FOR SALE

One Keeler water tube boiler 175 HP unit reconditioned underfeed stoker. Clarage blower. Hays draft guage. Republic steam flow meter, check and gate valve, blow-off valve. Deane boiler steam feed pump. All in good condition.

1—AC turbine, 300 KW, speed 3600 rpm, Bullock type generator 2300 V reconnected for 440 V, is used with motor driven exciter, 10 KW, 125 V. Also
3—Transformers, outside type, 440 V—150 KW.
1—500 gpm Union Lake pump with 30 HP motor.
2—Deep Well turbine pumps with 15 HP motor
2—3" Fairbanks Morse pumps with 7½ HP motor.

J. LASKIN & SONS CORP.
3728 North Fratney St. Milwaukee 12, Wis.

FOR SALE

1—Cummins Diesel Engine

85 H. P. Model H I P 600, No. 54224, with speedup gear unit, oil filter, base for complete unit, coupling for pump, cables, batteries, engine never been used, brand new.

HAROLD W. YEAGER, *Town Clerk*
Bellevue, Iowa

WANTED

—TRANSFORMERS—

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
MARIEMONT Since 1913 CINCINNATI 27, OHIO

WANTED

BUS DUCT & SWITCHES

Surplus—Any make or quantity
200 to 3,000 ampere
On Cash Basis

DAVIDSON
1265 Atlantic Ave. Brooklyn 16, N. Y.

Air Compressors Wanted

Horizontal Water Cooled—Any size
also 2 Stage portable units

L. W. BAUER
North Bergen, N. J.

IF THIS—OR ANY—ISSUE OF POWER DOES NOT CONTAIN

The Information You Want

ABOUT PRODUCTS, SPECIALTIES OR SERVICES, PLEASE WRITE:

POWER

TRANSFORMERS WANTED

Purchase or Rent

Three each 667 KVA, Single Phase, 60 cycle, oil Cooled, New or Used. Primary Voltage 66,000—Secondary Voltage 2200/4000. 2½% Tap on both Primary & Secondary Voltage.

S. A. HEALY COMPANY
14 Fisher Lane White Plains, N. Y.

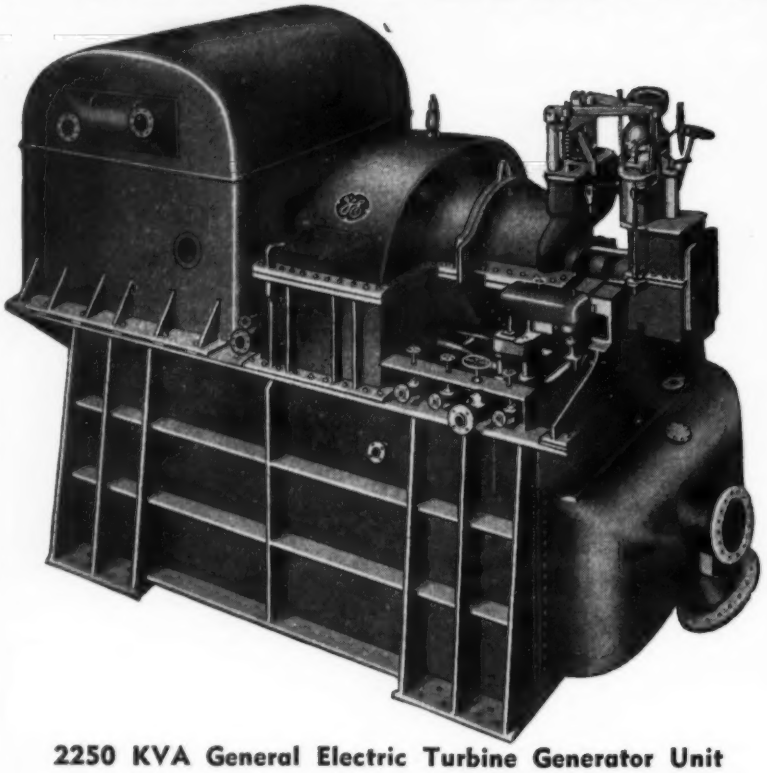
WANTED

REDUCTION UNITS

10 or 15-H.P. 220/3/60-cycle totally enclosed, worm or gear reduction unit, 45-RPM under load on 2 7/16" shaft. We could use several hundred of these.

SOUL CLINIC INC.
809 8th Ave. W., Calgary, Canada

POWER PLANT MACHINERY



2250 KVA General Electric Turbine Generator Unit

PACKAGE TYPE TURBINE GENERATOR UNITS AND BOILERS

2—1800 KW 80% P. F. 2250 KVA General Electric alternating current generators, type ATB, 3 phase, 60 cycle, 480/600/2300/4150 volts, 3600 RPM, direct connected to General Electric condensing turbines, 10 stage, 250/400# steam pressure, 0-175 deg. superheat, 725 deg. total temperature, 3600 RPM. Equipped with air coolers, surface condensers and auxiliaries.

4—60,000# steam per hour Foster Wheeler boilers, 435# pressure, 750 deg. TT, equipped with waterwalls, superheaters, economizers, soot blowers, and Todd oil burners.

NEW 1943—EXCELLENT CONDITION

CONDENSING TURBO UNITS

3 phase 60 cycle

2250 KVA (2) G. E. 480 v., 250/400# steam
1875 KVA (2) G. E. 2300 volts, 250# steam
1563 KVA G. E. 2300 volts, 225# steam
1250 KVA (2) G. E. 2400/480 v., 200#
625 KVA G. E. 2300 volts, 200# steam
375 KVA (5) G. E. 480 v., 400# steam

NONCONDENSING TURBO UNITS

3 phase 60 cycle

625 KVA G. E. 480 volts, 300# steam, 10# exhaust
625 KVA G. E. 2300 volts, 200# steam, 7# exhaust
250 KVA (5) G. E. 480/240 volts, 400# steam, 10# exhaust

SPECIAL

5—375 KVA G. E. condensing turbine generator units, 3 phase, 60 cycle, 480/240 volts; 400# steam pressure. Equipped direct connected exciters, surface condensers, and pumps. New 1943.

EXTRACTION TURBO UNITS

3 phase 60 cycle

1563 KVA Wstgh. 2400 volts, 175# steam, 15# extraction
1250 KVA Allis 480 volts, 300# steam, 35# extraction
940 KVA Wstgh. 600 volts, 150# steam, 20# extraction

UNIFLOW UNITS

3 phase 60 cycle

625 KVA Skinner, 2300 volts, 140# steam, 5# exhaust
375 KVA Skinner, 2300 volts, 150# steam, 5# exhaust
312 KVA Skinner, 480 volts, 165# steam, 5# exhaust
250 KVA Skinner, 480 volts, 165# steam, 5# exhaust
208 KVA Skinner, 240 volts, 125# steam, 5# exhaust

SYNCHRONOUS MOTORS

6—3500 HP G. E. totally enclosed synchronous motors, 3 phase, 60 cycle, 4000/2300/550/440 volts, 257 RPM. Equipped surface air coolers and couplings. New 1943.

DIESEL UNITS

3 phase 60 cycle

1250 KVA (2) General Motors, 2300 volts
250 KVA (2) General Motors, 450 volts
250 KVA Fairbanks Morse, 2300 volts
187 KVA (3) Fairbanks Morse, 2400 volts

GENERATORS

3 phase 60 cycle

2500 KVA (4) G. E. 2300/480 volts 257 RPM
750 KVA Wstgh. 460 volts, 150 RPM

MOTOR GENERATOR SETS

3 phase 60 cycle

200 KW G. E. 250 v. D. C., 440 v. A. C.
200 KW C. W. 125 v. D. C., 2300 v. A. C.

ROTARY CONVERTERS

3 phase 60 cycle

3500 KW G. E. 225/285 v. D. C., 13800 v. A. C.
1500 KW Wstgh. 270 v. D. C., 13800 v. A. C.
1500 KW Wstgh. 600 v. D. C., 4000 v. A. C.

TRANSFORMERS

18—25 KVA General Electric transformers, single phase, 60 cycle, 460-120 volts.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. PHONE LONG DISTANCE 350 CLEVELAND 14, OHIO

ROLLING UP NEW RECORDS FOR REAL VALUES!

HEMPHILL EQUIPMENT

JLHCo

REBUILT AND TESTED BY OUR ELECTRICAL ENGINEERS TO N.I.S.A. STANDARDS

TRANSFORMERS

2—500 KVA, G.E., HS, 2400/4800—240/480
300 KVA, Pitts., 7800-440 v.
205 KVA, Whse., 2 phase, 2300 to 3 ph., 4150 autp
200 KVA, Pitts., 4000 v.—110/220.
100 KVA, Pitts., 1375/2750 v.—110/220
3—100 KVA, Wagners, 240/120 v.—120 v.
2—100 KVA, Newark, 440 v., 2 phase to 220 v., 3 phase
2—100 KVA, Whse., 13,800 v. to 250 v.
100 KVA, American, 4150 v. to 230 v., 3 ph.
3— 75 KVA, G.E., 2400 v.—120/240
6— 50 KVA, Whse., 2400 v.—120/240
6— 50 KVA, Whse., 13,800 v. to 125 v. or 250 v.
6— 50 KVA, Whse., 6900 v. to 125 v. or 250 v.

A. C. GENERATORS

2500 KVA, Whse., Syn. Cond., 720 RPM, 2400 v.
500 KW, .8 P.F., 3600 RPM, ATB, 600 v.
320 KW, Allis, 450 RPM, 480 v.
240 KW, G.E. ATB, 600 RPM, 600 v.
200 KVA, Allis, 3600 RPM, 240 volt.
200 KVA, Whse., 600 RPM, 240 v.
180 KW, Whse., 514 RPM, 550 v.
2— 167 KVA, G.E., 1200 RPM, .6 P.F., 450 v.
165 KW, El. Mech., 514 RPM, 240 v.
100 KW, G.E. ATB, 600 RPM, 240 v.
75 KW, Whse., 900 RPM, 220 v.
62½ KW, Allis, 3600 RPM, 220 v.
7— 50 KVA, Whse., 900 RPM, 220 v.
50 KVA, Whse., 1200 RPM, 220 v.
3— 35 KW, Columbia, 1200 RPM, 240 v.
1— 31.3 KVA, America, 1200 RPM, 120/208
15 KW Star, 1800 RPM, 220/440
12.5 KVA, Whse., 1200 RPM, 240 v.

TURBINE BLOWERS

1—Spencer Turbine Blower, 1000 cubic feet, 30 oz. pressure with a 15 H.P., 3600 RPM, General Electric Type FT, 200 volt motor.

1—Bellmore, 550 cubic feet, 7 inch vacuum, with a 20 H.P. 3600 RPM, General Electric, Type K, 220 volt, 3 phase motor.

MOTORS, 3 phase, 60 cycle
SQUIRREL CAGE

750 H.P., General Electric, 750 RPM, 6600 v., 25 cycle
450 H.P., Ridgeway, 900 RPM, 2200 volts
150 H.P., G.E., LK, 450 RPM, 440 volts
125 H.P., G.E., KF, 1750 RPM, 2200 v.
125 H.P., U.S., 1200 RPM, Vert., 220 volts
150 H.P., G.E., KT, 1200 RPM, Vert., 220 volts
75 H.P., West., CS, 1750 RPM, 440 volts
75 H.P., G.E., 1200 RPM, 2200 volts
60 H.P., Whse., 900 RPM, Vert., 2200 volts
60 H.P., Whse., 900 RPM, 440 volts
2— 40 H.P., G.E., 900 RPM, 220 volts.
35 H.P., Whse., 1200 RPM, CS, 2200 volts
35 G.E., 600 RPM, 550 volts
25 H.P., U.S., 1800/1200/900/600, 440 volt
2— 10 H.P., Whse., Gear 440 RPM, 440 volt

MOTORS, 3 phase, 60 cycle
SLIP RING

450 H.P., G.E., 425 RPM, ITC, 440 volts, 25 cycle
200 H.P., G. E., MT, 440 volt, BB, 725 RPM
100 H.P., G.E., IM, 440 volt, 25 cycle, 720 RPM
75 HP., Whse., CW, 720 RPM, 440 volt
75 H.P., G.E., MT, 1200 RPM, Vert.
50 H.P., G.E., MT, 600 RPM, 220 volt
2— 50 H.P., Whse., CW, 900 RPM, 220 volts
40 H.P., Cont., 1200 RPM, JAS5, 220 volt
40 H.P., G.E., 1200 RPM, MT, 220 volt
40 H.P., G.E., 900 RPM, 220 volt, ITC
40 H.P., G.E., 900 RPM, MT, 900 RPM, 220 volt
40 H.P., G.E., 900 RPM, 2200 volt
40 H.P., Triumph, 600 RPM, 2200 volt
35 H.P., Allis, 900 RPM, 220 volt
30 H.P., G.E., M 1160 RPM, 220/440 volt

LARGE STOCK OF
D.C. MOTORS AND GENERATORS

SYNCHRONOUS MOTORS

200 H.P., Whse., 600 RPM, 240 v.
150 H.P., G.E., 900 RPM, 4150 v., TS
75 H.P., G.E., 1200 RPM, 440 v.
70 H.P., Elect. Mach., 180 RPM, 220 v.
40 H.P., Whse., 1800 RPM, 220 v.
35 H.P., G.E., 1200 RPM, 2200 v.
20 H.P., Whse., 1800 RPM, 220 v.

MOTOR GEN. SETS

125 KW, CW, 125 v., 1200 RPM, 2300 v. sq. cage
100 KW, El. Mach., 125 v., 1200 RPM, 4150 v., syn.
100 KW, G.E., 230 v., 900 RPM, 4150 v. syn.
2— 75 KW, G.E., 125 v., 1200 RPM, 220/440 v.
6— 75 KW, G.E., 60 v., 1200 RPM, 220/440 v.
50 KW, Ridgeway, 550 v., 1200 RPM, 220 v.
25 KW, G.E., AT1, 1800 RPM, 40 HP, 1800 RPM, 230 v.
15 KW, Whse., 250 v., 1200 RPM, CS, 220 v.
10 KW, Whse, 250 v., 1200 RPM, IK, 220 v.
5 KW, G.E., 115 v., 1800 RPM, 240 v.
5 KW, Wotten, 120 v., 1800 RPM, 220 v.

PLATING M. G. SETS

250 amp., G.E., 5/6 volt, 220 v.
500 Amp., Hansen Van Winkle, 24 volt, 220/440 v.
2500 Amp., Chandeysson, 6/12 v., 400 RPM, Syn., 440 v.
3000 Amp., Chandeysson, 6/12, 400 RPM, syn., 440 v.

ENGINE GEN. SETS

150 KVA, G.E., Ames Uniflow, 220 v., 3 ph., non. cond.
2— 5 KW, Gasoline, Hobart, 1800 RPM, 120 v., 1 ph. cont. engines 200/275 v., gasoline Van Blerck, 8 cyl, 1500 RPM, grav 900 RPM

TURBO. GEN. SETS

625 KVA, Westinghouse, 2400 v., 3 phase, non cond.
300 KW, G.E., ATB, 240 v., 3 ph., cond.
60 KW, Whse., 120 v., D.C., cond.
50 KW, Whse., 120 v., D.C., cond.
30 KW, Allis, 120 v., D.C., Terry non cond.

JLHCo

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

J.L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

Reliably Rebuilt—YEAR Guarantee

A. C. Motors Generators

Squirrel Cage Motors

H.P.	Make	Type	Speed
200	Al. Ch.		600
150	El. Mchn.		1200
150	Al. Ch.		514
147	West.	25 cy.	715
125	El. Prod.	B.B.	1150
125	Al. Ch.		450
100	West.	XP	3600
100	G.E.		1200
75	Al. Ch.		3600
75	G.E.	IK	1800
75	G.E.	KT-347	1200
60	G.E. (2)	KG	1800
50	G.E.	KF-504	1150
50	Ideal	A	1150
50	G.E. (2)	XP	1800
50	E.D. (5)	TEFC	1800
25	West.	3S-364	3450

Slipring Motors

600	Cr. Wh.		514
150	G.E.	IM	600
100	Al. Ch.		695
100	Wagner	25 cy.	480
75	G.E.	IM	690
60	G.E.	TEFC	720
50	Al. Ch.	ARY	600
50	G.E. (2)		514
40	G.E.	IM	1200
40	G.E.	MT-352	600
30	West. (2)	CI	900
30	G.E.	MT-542	720

Synchronous Motors

600	G.E.	900
2-200	Ideal	257
50	G.E.	1200

Generators

KW	Make	Speed
150	G.E.	600

D.C. to A.C. Gen.

KW	Make	D.C.	A.C.
25	G.E.	230	220
25	Star	115	120
25	Ideal	115	440
25	El. Mchy.	230	440
7½	Hertner	115	440
5	El. Spec.	110	110

D. C. Motors

230 V. Variable Speed

H.P.	Make	Type	Speed
100	Rel.	1050T	400/1000
100	G.E.	CD173	400/1200
75	Cr. Wh.	CMC	375/750
60	G.E.	C	480/1100
50	West.		250/1000
50	West.	SK	500/1500
40	G.E.	CD	500/1500
35	G.E.	RF	500/1500
25	G.E. (3)	RF12	500/1500
25	G.E.	RF13	400/1600
25	West.	SK140	400/1200
20	G.E. (2)	RF12	400/1200
15	West.	SK93	600/1200
15	E.D.	10S	500/1500
15	West.	SK	250/1500
10	G.E.	RF10	600/1800
10	West.	SK	600/1200
10	G.E.	RF	400/1600
10	G.E.	RF	400/1200

230 V.

150	G.E.	RC19	800
100	G.E.	CDP	1750
60	West.	SK160	680
50	West.	SK133	1300
50	Diehl	K10	850
50	West.	SK	750
50	West. (3)	SK160	585
40	G.E.	RC	1750
40	West. (2)	SK103	1750
40	G.E.	RC	1075
40	G.E. (2)	DLC	1050
35	West.	SK	1150
30	G.E.	RC	1100
30	West.	SK	975
30	West. (2)	SK143	575
25	Rel.	92T	1150
25	West. (4)	SK113	860
25	E.D.	10S	800
20	West.	SK60	1750
20	West.	SK83	1750
20	G.E.	CD	1200
20	Star (2)	SHB30	29

115 V.

30	C-W	CCM-FH	850
25	G.E.	CDM85	1800
25	G.E.	CDM95	1200
20	G.E.	CD83	1750
20	West.	SK110L	750
10	L.A.	ONA284	3500

D. C. Generators

600 V.

KW	Make	Speed
200	Cr. Wh.	900
30	Burke	1750
30	E.D.	1150

250 V.

KW	Make	Speed
330	Elliot	1200
300 (2)	G.E.	1200
200	G.E. MPC	1200
150	West.	900
150	West.	1180
150	G.E.	600
50	G.E.	1200
30 (3)	G.E.	1750
30	Cont.	1200
25	G.E.	1200
15	G.E.	1750
10	Star	1750
7½	West.	1200
5	West.	1750

125 V.

KW	Make	Speed
250	G.E.	720
100 (2)	West.	900
100	G.E.	1200
50	Sturt.	2800
40	Cent.	1450
20	Delco	1200
15	G.E.	1150
10	Rogers	1450
7½	West.	1200
5	G.E.	1750

Low Voltage

Amp.	Make	Voltage
8000	H-V-W.	6/12
6000	Chandeysson	6/12
6000	M-B-O'C. (2)	6/12
5000	M-B-O'C. (2)	6/12
5000	Col.	8/16
2000	H-V-W.	6/12
1000	Chandeysson	6/12
1000	Col.	6/12
125	Hobart (8)	7½
1000	H-V-W.	12/24
300	Star	15
67	Cont.	15
750	Star	15
1000	G.E.	15
800	G.E.	22/23
600	Rel.	24
134	West.	24
175	Cr. Wh.	25
550	Col.	27
1600	G.E.	30
800	G.E.	30
100	G.E.	30
200	West.	30
205	G.E.	32
1000	G.E.	33
205	G.E.	42
24	G.E.	44/54
75	G.E.	50/10
800	G.E.	50
1500	G.E.	50
400	G.E.	60
1500	Century	60
1500	El. Prod.	65
1000	G.E.	75

Miscellaneous

Pyrometers

40—Leeds & Northrup Model C-S & R.

D.C. Starters

150—230 V. Cutler-Hammer, D.C. automatic, 5 H.P. to 75 H.P.
100—230 V. Cutler-Hammer, manual 1 H.P. to 3 H.P.
250—5 H.P. 115 V. Cutler-Hammer, magnetic.
75—1½ H.P. 230 V. General Electric, compound.
40—7½ H.P. 230 V. Cutler-Hammer reversing magnetic.

A.C. Starters

1—250—H.P. 4150 V.
1—150/200 H.P. G.E. Red, Volt. 440 V. Synchronous Starter.
40—Magnetic multi-speed A.C.
40—50 H.P. Cutler-Hammer up to 25 H.P. 440 V.
300—25 H.P. Ward-Leonard, 440 V.
1100—7½ H.P. Cutler-Hammer 440 V.

Air Compressors

10x6 Gardner, 30 lbs.
12½x12 American, 125 lbs.

Pumps

LeCourtney—5 stage, 675 GPM, 1100 ft. head.

M.D. Blowers

50—1200 CFM — American, 3" static.
100—3000 CFM—U.S., 3" static
75—20 CFM—Bayley, 2" static.
2—½ H.P. Spencer.

230 V. D.C. Monorail Hoist

17—4000# Shepard
1—4000# Cleveland

SPEED REDUCERS
REEVES & LEWELLEN DRIVES
Send for Complete List.

400 Cycle Generators

8—½ to 5 KVA.

Meters

20—Weston Portable — A.C. and D.C. Model 155.

ONLY PARTIAL LIST—SEND FOR No. 11

EST. 1910 → **L. J. LAND INC.** ← 39TH YEAR

146 GRAND STREET, NEW YORK 13, N. Y.
PHONE: CAnal 6-6976

New England Representative:
BOSTON, MASS.
411 Atlantic Ave.
Phone: Liberty 4300

South Western Representative
HOUSTON, TEXAS, 1400 Carr St., Phone: Charter 4-6558

Pennsylvania Office
READING, PENNA.
10th & Exeter Sts.
Phone: Reading 2-6866

The BELYEA Reputation for Value has been building for the past 40 years!

SUCCESSFUL OPERATION GUARANTEED

RE·NU·BILT

RE NU BILT — BELYEA — MOTORS

ELECTRICAL EQUIPMENT REBUILT BY SPECIALISTS

We own outright all machines listed on this page

SPECIAL

1—3 Unit—200 KW—Syn M-G Set—440 V., 3 ph. 60 cy., Motor with 2—100 KW., 250 V. Gen.—Also 2—125 HP, 1750 RPM, 250 V. D.C. Motors—Reduced Voltage, A.C. Starter and Amplidyne Control for D.C. Motors. Also Exciter M-G.

SPECIAL

General Electric Spirakone Transformers, 167 KVA, 2400/4160 Y Volt Primary, 120/240 Volt Secondary, Single Phase, 60 Cycle, O.I.S.C. Can Also 240/480 Volt Secondary. Newly Wound.

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	360	275	2200/4400
1	1000	Whse.	900	600	11000*
1	1000	G.E.	720	600	4000
1	1000	West.	514	250	4150
2	1000	Whse.	900	600	6600/12500
1	1000	Al. Ch.	720	450	2300
2	750	Whse.	900	275	6600
2	500	G.E.	720	600	2300/4150
1	500	G.E.	720	600	6600/13200
1	500	G.E.	720	600	4400
1	500	G.E.	720	125	6600/13200
1	400	Whse.	1200	250	440/2300
1	300	G.E.	720	550	2300/4000
1	250	G.E.	720	275	2300/4000
1	250	G.E.	1200	250	440
2	200	Cr. Wh.	1200	250	208
1	100	G.E.	1170	125	220
4	90	G.E.	1180	60	220/440
1	75	Cr. Wh.	1160	250	220/440
1	75	G.E.	1180	125	2300/4000
1	60	Cr. Wh.	1750	250	220/440
1	50	G.E.	1145	125	220
2	50	G.E.	1200	250	2200

*Full automatic AC & DC control.

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 Unit—3 Brg. Consisting of—1400 HP—4400 V, 3 ph. 25 Cy. Motor and 1000 KW—2300 V. —8 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)

1—320 KW—GE—2 Unit—3 Brg. consisting of 600 HP—440 V., 3 ph. 60 cy., .8 pf. Syn. Motor and 400 KVA .8 pf. type AT—3 ph. 120 cy. 720 volt AC generator with direct connected exciter.

ROTARY CONVERTERS

60 cycle

KW	Make	Speed	D.C. Volts	A.C. Volts
1—1500	Whse.	720	600	2300
1—1000	G.E.	900	600	11000
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 750	Whse.	720	250	6600
1— 500	G.E.	900	250	2300

D. C. MOTORS

HP	Make	Type	Volts	Speed
6—1500	Wh e.		525	600
1—1200	Wh e.		600	425
1—800/1000	Wh e.		450	600/720
1—800	G.E.	MPC	600	600
1—765	G.E.	MPC	500	1045/1350
1—700	G.E.	MCF	600	150/525
1—650	G.E.	MPC	250	115/145
1—375	G.E.	MPC	230	450/900
1—335	Whse.	Mo	250	300/900
1—300	G.E.	MPC	230	275/550
1—230	Al. Ch.		230	700
1—150	G.E.	MPC	230	250/450
1—150	Cr. Wh.	CCM	230	300/1050
1—150	Cr. Wh.	CMC-65H	230	1150
2—125	G.E.	CO-1832	230	625
1—115	Cr. Wh.	JHL	230	1200
4—101	Whse.	SK	230	485/950
1— 80	El. Dy.	30S	230	500/1500
8— 75	Cr. Wh.	53-H	230	860
1— 75	Cr. Wh.	CMC	230	1150/1760
1— 60	El. Dy.	25-S	230	525/1050
2— 60	Whse.	Hoist.	230	415
1— 60	Whse.	SK	230	500/1000
1— 60	Whse.	SK-131	230	500/1500
2— 50	G.E.	RCP-31B	230	1700
1— 50	G.E.	RC-34	230	1050
1— 50	G.E.	RF-16	230	500/1500
1— 50	Whse.	SK-131	230	500/1500
4— 50	Whse.	Hoist.	230	400
1— 50	Whse.	SK-153	230	690/1035
1— 50	G.E.	CD-123	230	675/1035
1— 50	Whse.	SK-170	230	350/1050
1— 50	Cr. Wh.	CMC-8014	230	380/750
1— 50	Rel.	461-T	230	250/1000
5— 40	Rel.	385-T	230	400/1500

These units are semi-enclosed, b, brg. motors and part of complete V-S Drive with 40 KW Ind. M. G. Set with 220/440 v. A. C. Motor; exciter and complete control equipment. M. G. and control in steel enclosure.

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	4000	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	500	G.E.	ATI	480	900

SPECIAL

500 HP—GE—KF-559—3575 RPM—2300 Volt Sg. Cy. Motor connected to Byron Jackson 325 GPM—10 stage, 3500 ft. head pump.

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	510
1—1000	Whse.		2300	189½
1— 320	G.E.	ATI	2300	600
2— 900	Al. Ch.	(New)	2200	150
1— 500	G.E.	ATI	480	900
2— 450	Whse.		2300	1800
2— 350	G.E.	TS	2200	150
2— 300	Al. Ch.		2300	505
1— 125	Whse.	32AG	440	514
1— 100	Whse.		550	600
1— 85	G.E.	TS	440	1800

SLIP RING

1—1000	Whse.	CW	2300	700
1— 900	G.E.	IM	2300	880
1— 350	G.E.	MT-442Y	2200/4000	253
1— 300	Whse.	CW	440	1750
1— 250	G.E.	MT-563Y	550	900
2— 200	G.E.	IM	440/550	435
1— 250	G.E.	MT-424Y	4000	257
2— 100	G.E.	IM-16	2200	435
1— 75	Whse.	CW-761	2300	1750
1— 75	F.M.	By-H16B	2300	1750
3— 50	Whse.	CI-638A	220	870
2— 50	Whse.	CIW-504	440	870
1— 50	Rel.	1XM	2300	880
1— 50	G.E.	MT-352	550	600

SQUIRREL CAGE

1— 250	West.	CS-7111	2200	3530
1— 250	G.E.	IK	440	600
1— 200	G.E.	IK	550	865
1— 100	G.E.	IK	2200	600
1— 100	G.E.	IK-Vert.	2300	450
2— 75	G.E.	K	2200	1200
1— 50	G.E.	KF-405S	220/440	3550
2— 50	Whse.	CS	220	870
1— 50	G.E.	KT-327	2200	1750
1— 50	Whse.	C-S	440	1755

Turbo Generators

See our advertisement on page 279

SPECIAL—MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RHW—6 Anode 575 V., D.C. Form C with 2300 V., 60 cycle transformer and switching equipment.

1—500 KW—GE—Type RHW—6 Anode 575 V., D.C. Form B with 2300 V., 60 cycle transformer and switching equipment.

BELYEA COMPANY, INC.

"OUR REPUTATION IS *YOUR* PROTECTION!"

Main Office and Shop

43 HOWELL ST. JERSEY CITY 6, N. J.

Phone—Journal Square 2-3334

Also N. Y. City Line—Rector 2-7150

GLOW

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
350	514	440	GE-I
250	600	2300	Triumph
200	600	220	Wtg.
223	3600	4150	GE-FR
150	600	2300	GE-I16
125	600	2300	GE-FTR
125	340	220	A-C
100	514	220	A-C
75	720	2300	Wagner
75	360	220	GE-I
60	3600	2300	GE-KT
50	900	220	GE
50	720	2300	Wtg.-CS
40	900	2300	Wtg.-CS
35	600	220	FT. Wayne
30	720	220	GE-HI
25	900	220	GE-FTR
25	720	220	Wagner
25	600	440	GE-I
25	900	440	GE
20*	1800	220/440	Wesche
20	900	440	Wtg.-CCL
20*	1800	220/440	Master
15	3600	220	GE-KT
15	1800	220	W-E
15*	1800	220/440	Master

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
125*	1200	440	GE-TEFC-BB
30	900	440	GE-TEFC-BB
15	1200	220/440	Delco-TEFC-BB
7½*	1800	dual	Wagner-TEFC-BB
7½*	1800	dual	Master-TEFC-BB
7½	1200	dual	GE-HI Slip-TEFC-BB
7½	1090	220/440	GE-KR, high slip
5*	1800	dual	Master-TEI C-BB
5	1800	220	Wagner TE-BB
5*	1200	dual	GE-TEFC-BB
3	3600	440	Wtg.-TE-BB
3	1800	dual	Delco-TEFC-BB
3	1200	dual	Rel-TEFC-BB
2	1200	220	GE-TE-BB
2	900	220	Wagner-TE-BB
2	1800	dual	Delco-TEFC-BB
2	1800	dual	Delco-TEFC-BB
1½	900	dual	L. Al.-TE-BB
1½	1800	dual	Rel-TE-BB
1½	1200	dual	Haskins-TEFC
1	3600	220	Master-TEFC-BB
1	1800	dual	Delco-TE-BB
1*	1800	dual	Rel-TE-BB
1*	1200	dual	Delco-TE
¾	3600	440	Wesche-TE-BB
¾	1800	dual	Ohio-TE-BB
¾	3600	220	Wtg.-TE-BB
¾	1800	440	Delco-TE-BB
¾*	1800	dual	GE-TE
¾	1200	220	Cr. Wh.-TE
¾	3600	440	GE-TE
½	1800	220	Delco-TE-BB
½	1800	440	Delco-TE-BB
½	1800	440	Delco-TE-BB

* New Motor

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
375	1800	2300	Al. Ch.
235	1800	2204	GE-I
250	300	2300	Al. Ch.
200	514	440	Triumph-C
75	360	220	GE-I-M
60	1800	dual	Al. Ch.
60	900	2300	Burke
60	900	220	Wesche
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al. Ch.
40	1200	220	GE-MT-336
40	900	2300	Al. Ch.
40	900	220	Wtg.-HF
40	720	2300	Wtg.-HF
40	720	220	Al. Ch-ANY
40	600	2300	Al. Ch-ANY
40	600	220	Al. Ch-ANY
40	450	220	Triumph-C
35	900	2300	Ridgeway
35	720	220	GE-I
30	1800	2300	Wtg.-CW
30	1200	2300	Lincoln
30	900	220	GE-MT
30	900	2300	Ridgeway
30	720	220	GE-I
30	600	220	F. Morse-BV
30	1200	440	Wagner
25	1200	2300	Al. Ch-ANY
25	1200	220/440	Watson-KH
25	900	220	GE-MT
20	1800	440	Al. Ch.
20	900	2300	GE-I
20	865	440	Wtg.-HF

VERTICAL MOTORS

HP	RPM	Volts	Make
200	1200	440	Al. Ch.-SR
150	1200	2300	GE-SR
150	1200	440	GE-Cage
125	1200	2300	Al. Ch.-Cage
100	1200	440	GE-Cage
75	1200	2200	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 D.C.	GE
60	1200	440	Al. Ch.-Cage
50	1800	440	GE-Cage
50	1200	2200	Wtg.-Cage
50	600	440	Al. Ch.-Cage
40	1800	220	GE-Cage
40	1700	230 D.C.	GE
40	1200	440	Wtg.-SR
40	1200	220	GE-Cage
40	950	230 D.C.	Wtg.
35	1800	440	GE-Cage
35	1200	2300	Al. Ch.-Cage
35	450	440	GE-Cage
30	1200	dual	Wtg.-Cage
25*	1550	230 D.C.	GE
25	1200	2200	GE-Cage

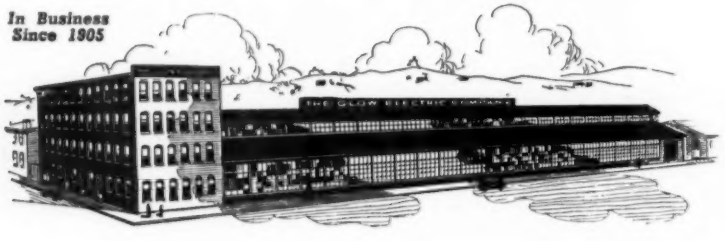
VERTICAL MOTORS—Cont'd.

HP	RPM	Volts	Make
25	850	230 D.C.	Wtg.
20	1200	440	Al. Ch.-Cage
15*	1800	440	Al. Ch.-Cage
15	1750	110 D.C.	Wtg.
15	1150	230 D.C.	GE
15	600	440	Al. Ch.-Cage
12½	900	220	L. Al.-Cage
10	3400	230 D.C.	Wtg.
10	900	220	Wtg.-Cage
7½	1800	500 D.C.	Peerless
7½	900	440	Burke
7½	700	230 D.C.	GE
6	850	110 D.C.	Rel.
5	1400	230 D.C.	R. & M.
5	600	440	GE-Cage
4	1650	110 D.C.	Watson
3	1700	230 D.C.	Watson
3	1200	dual	Wtg.-Cage
3	900	440	Wtg.-Cage
3	600	dual	Wtg.-Cage
2	1800	230 D.C.	GE
2	1150	230 D.C.	Wtg.
2	900	220	GE-Cage
1	1200	220	GE-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
710	720	13200/6600	GE-ATI
250	225	2200	GE
250	225	440	GE
200	225	2200	Wtg.
175	225	208	GE
160	600	440	GE
160	164	440	GE
120	225	220	E-M
115	164	208	GE
60	360	2200	GE
50	360	440	GE
30	900	440	Wagner
30	600	550	GE
30	450	dual	Wtg.
30	360	550	GE
30	327	220	E-M
25	1800	220	Wagner
25	450	220	E-M
25	300	220	Ideal
20	900	220	Wtg.
20	600	220	E-M
15	1800	220	Wagner
10	1800	220	Wagner
10	1200	220	Wagner
7½	1200	440	Wagner

In Business Since 1905



TRANSFORMERS

General Electric Spirakore Transformers, 167 KVA, 2400/4160Y volt primary, 120/240 volt secondary, 1 phase, 60 cycle, oil cooled, outdoor type. Alternative same except secondary 240 or 480 volt.

DIRECT CURRENT GENERATORS

KW	Volts	RPM	Manufacturer	Description
400	120/240	300	Westinghouse	Compound, Interpole Pedestal Bearings
200	250	375	Jantz & Leist	Compound Wound, Pedestal Bearings
175	250	450	Westinghouse	Compound Wound, Pedestal Bearings
80	125	500	Jantz & Leist	Compound Wound, Double Shaft Extension
80	125	400	Jantz & Leist	Compound Wound, Double Shaft Extension
30	250	300	Triumph	Compound Wound
22½	250	765	Westinghouse	Compound Wound

MOTOR GENERATOR SETS

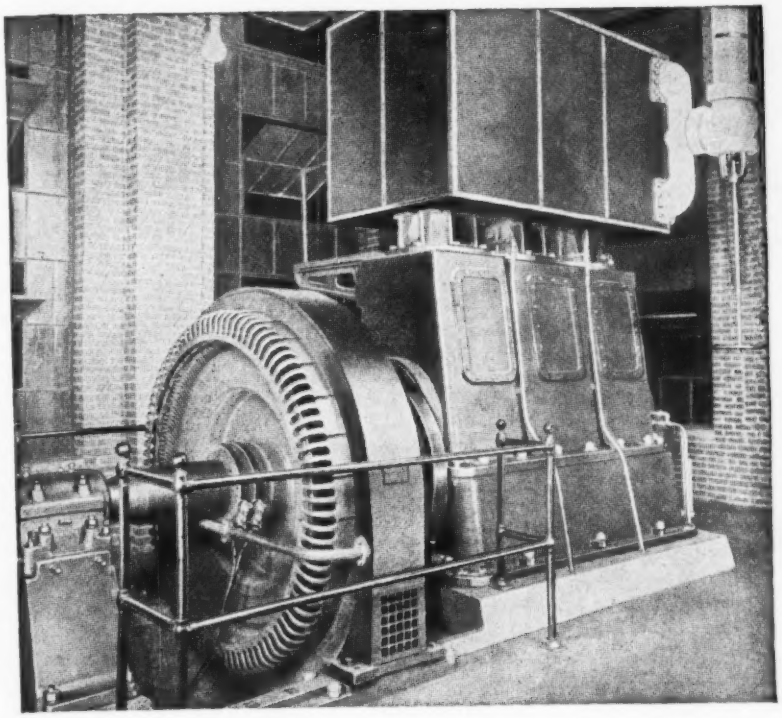
KW	Volts	Generator Mfgr.	A. C. Motor
500	600	General Electric	710 HP, 1 P.F., 720 RPM, 13200/6600 Volts, General Electric Synchronous
200	125	General Electric	300 HP, 900 RPM, General Electric, Synchronous
90	125	General Electric	130 HP, 750 RPM, 440 Volts, General Electric, slip ring
60	250	Delco	100 HP, 1750 RPM, 2300 Volts, Squirrel Cage, Burke
50	120/125	Burke	95 HP, 1200 RPM, Burke, Synchronous
40	250	Reliance	60 HP, 1800 RPM, Century, Induction
32	115/115	General Electric	50 HP, 1800 RPM, 440 Volts, General Electric, Squirrel Cage
25	125	General Electric	35 HP, 1200 RPM, General Electric, Induction

ELECTRIC CO

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

927 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

POWER PLANT MACHINERY - IMMEDIATE DELIVERY



960 I.H.P., 18" diameter x 16" stroke, 3 cylinder, 327 RPM Skinner Vertical Unaflow non-condensing engine, 150 lbs. pressure direct connected to a 750 KVA—600 KW, 80% P.F., 40° C rise, 3 phase, 60 cycle, 2300/600/480/240/208 volts 327 RPM Electric Machinery alternating current generator equipped with a 15 KW, 125 volt, 1450 RPM V-belt Electric Machinery Exciter, Switchboard panel with instruments and General Electric voltage regulator.

ACTUAL PHOTOGRAPH

← EXCELLENT CONDITION

COMPLETE INSTALLATION

TURBINE-GENERATOR UNITS
3 phase, 60 cycle

1875 KVA G. E. condensing, 250 lbs. pressure, 2300 volts, 3600 RPM, complete surface condenser.

1250 KVA G.E. condensing, 250 lbs. pressure, 550° T.T. 480/600 volts, 3600 RPM, complete shaft exciter, switchboard and condenser.

1250 KVA G.E. condensing, 200 lbs. pressure, 2300 volt, 3600 RPM complete exciter, condenser, panel.

625 KVA G.E. non-condensing 150 lbs. pressure, 15 lbs. back, 2300 volts, 3600 RPM complete exciter, panel.

625 KVA G.E. condensing, 150-175 lbs. pressure, 480 volts, 3600 RPM, complete exciter, switchboard, surface condenser.

500 KVA Westinghouse non-condensing 150 lbs. pressure, 10 lbs. back 240 volt, complete exciter and switchboard.

375 KVA G.E. condensing, 125 lbs. pressure, 2300 volt, 3600 RPM complete surface condenser and panel.

125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts with exciter, panel.

125 KVA G.E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.

120 KVA G.E. -Moore non-condensing 250 lbs. pressure, 7 lbs. gauge back, 240 volts, complete with switchboard.

100 KVA Westinghouse non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back 2400/600 volts, 3600 RPM.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle, 4000/6600 volts synchronous motor.

500 KW Allis 250 volt, 1200 RPM direct current Generator direct connected to 3 phase, 60 cycle, 4000 volts Synchronous Motor.

62½ KVA G.E. 3 phase 60 cycle, 2300 volts, 1200 RPM alternator direct connected 75 HP, 115 volts direct current motor.

50 KW Westinghouse, 125 volt, direct current generator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt motor.

ENGINE-GENERATOR UNITS
DIRECT CURRENT

400 KW Maximum, Crocker Wheeler 125 volt, 300 RPM Generator direct connected to Skinner Unaflow Engine.

250 KW, Crocker-Wheeler 250 volt, 257 RPM generator direct connected to 360 HP, 6 cylinder late type Fairbanks-Morse full Diesel engine—complete.

200 KW (3) New G.E. 120 volt Marine type turbine generator units.

200 KW Burke 3-wire 250 volt, 360 RPM generator direct connected Ames 4 cylinder vertical Unaflow non-condensing engine, 150 lbs. pressure complete switchboard.

200 KW G.E. 125 volt, 200 RPM generator direct connected Skinner Unaflow engine.

150 KW Westinghouse 250 volt generator direct connected to Ames Unaflow engine.

75 KW Allis Chalmers-Terry, 125 volts, 2400 RPM 150 lbs. pressure non-condensing turbine generator unit.

60 KW (3) *New* West. 120 volt Marine type turbine generator units.

ENGINE-GENERATOR UNITS
ALTERNATING CURRENT—3 phase, 60 cycle

500 KVA Westinghouse, 460 volt, 164 RPM Generator direct connected to 26" x 28" Skinner Unaflow non-condensing engine 140-160 lbs. pressure, 0-10 lbs. gauge back.

500 KVA Westinghouse 600 volt, 514 RPM Generator.

375 KVA G.E. 2300/480 volt, 180 RPM Generator direct connected to 21"x24" Chuse non-releasing Engine.

250 KVA (2) G.E. 2300/440/240 volts, 200 RPM generators each direct connected to 21" x 22" Skinner Universal engine.

200 KVA Crocker Wheeler 240 volts, 400 RPM generator direct connected to Ames Unaflow engine.

225 KVA E.M. 2300 volts, 200 RPM generator direct connected to 19"x24" Chuse Unaflow poppet valve engine.

187 KVA G.E. 2300 volt, 225 RPM Generator direct connected to 15"x19" Chuse non-releasing Engine.

180 KVA G.E. 240/440 or 550 volts, 200 RPM generator direct connected to 18"x21" Chuse non-releasing Corliss engine.

Utilities Electrical Machinery Corporation

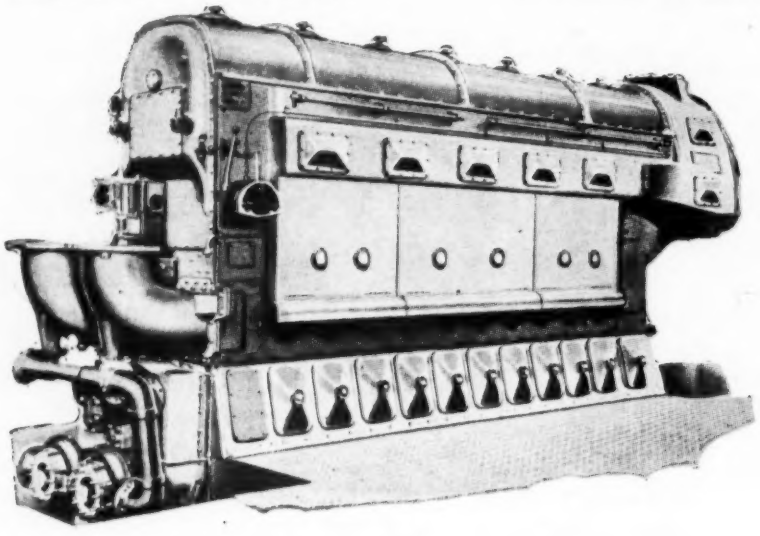
600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

TURBINE-GENERATORS Our SPECIALTY

Other Specialties: Diesel Power, Boilers, Genl. Power Plant Equipment

DIESEL POWER IN STOCK: ***IMMEDIATE SHIPMENT***



TURBO-GENERATORS

A Few Stock Machines are Noted Below

12—Fairbanks-Morse 1600-HP., Model 38D8-⅛, Diesel Engines

4—400 Enterprise 400-RPM., 6-Cyl., Latest Model—NEW

Ref. No.	
1	5000-KVA, G. E., 200#—100°, 2300 V.
2	3750-KVA, G. E., 200#—2300V, Cond (2)
3	3750-KVA, West., 200#—2300 V, Cond.
4	3125-KVA, West., 200#—2300 V, Cond.
5	2500-KVA, Allis, 200#—2300 V, Cond.
6	2500-KVA, Allis, 200#—480 V, Cond.
7	1875-KVA, G. E., 200#—2300 V, Cond. (2)
8	1875-KVA, Allis 200#—2300 V, Cond.
9	1875-KVA, West., 200#—480 V, Cond.
10	1875-KVA, Allis 200#—480 V, Cond.
11	1565-KVA, G. E., 150#—2300 V, Cond.
12	1250-KVA, Allis, 200#—2300 V, Cond.
13	1250-KVA, West., 200#—2300 V, Cond.
14	937-KVA, G. E., 200#—480 V, Non-Cond.
15	937-KVA, G. E. 200#—2300 V, Non-Cond.
16	937-KVA, Allis, 200#—480 V, Cond.
17	625-KVA, G. E., 200#—2300 V, Non-Cond. (2).
18	625-KVA, G. E., 200#—220/480 V, Cond.
19	500-KW—Several Units in stock, General Electric, Westinghouse, etc.

Have a large number of Turbo-Generators not listed. Send specifications of item if not listed

WE SPECIALIZE IN TURBINE GENERATORS

ALWAYS GET WEAVER CO.'S PRICES BEFORE BUYING

Tremendous Savings Possible

NEW CONDENSERS IN STOCK—Latest Models

11—100-sq. ft.; 8—580, 3—581 and 2—585 sq. ft.: Also 3—2200, 3—3300, and All NEW: Modern Laning NEW Circulating Water Pumps, Condensates, Evactors Made Specially for our New Condensers

25% to 65% SAVING ON THESE ITEMS. Bulletins 205, 208 Illustrate-Describe Them Write for Bulletins Today: Are Free: *Also No. 280—OUR NEW 1948 STOCK LIST—IT IS WORTH FILING:* All Free

COOPERATION INVITED:
Write, Wire, Telephone—NOW

CHARLES WEAVER & COMPANY

Mechanical-Electrical Engineers

4045 PENOBSCOT BUILDING DETROIT 26, MICHIGAN

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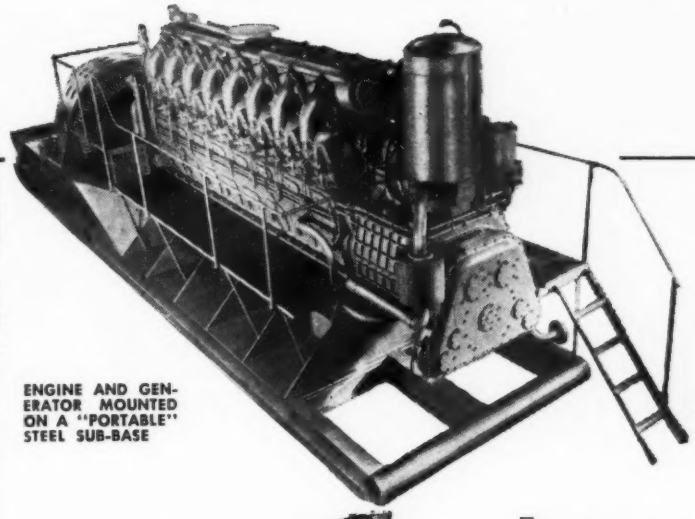
TURBINE-GENERATORS • DIESEL POWER • BOILERS • GENL. POWER PLANT EQUIPMENT

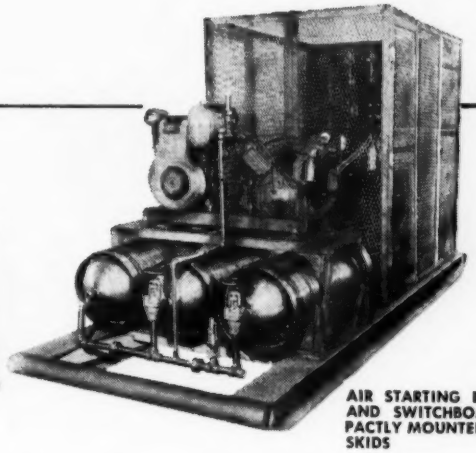
NEW 1948 STOCK LIST JUST OUT: FREE: SEND TODAY.

PORTABLE DIESEL PLANTS

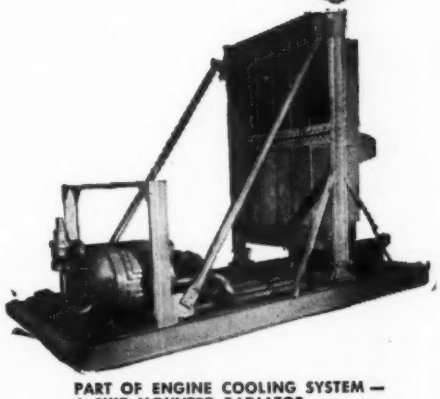
OFFERED FOR QUICK DELIVERY



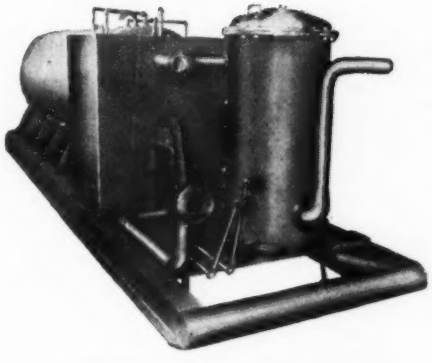
ENGINE AND GENERATOR MOUNTED ON A "PORTABLE" STEEL SUB-BASE



AIR STARTING EQUIPMENT AND SWITCHBOARD COMPACTLY MOUNTED ON STEEL SKIDS



PART OF ENGINE COOLING SYSTEM — A SKID-MOUNTED RADIATOR



FUEL OIL DAY TANK, ENGINE SUMP TANK AND FILTER, MOUNTED ON STEEL SKIDS

IDEAL FOR *HEAVY DUTY SERVICE* WHERE POWER *IS NEEDED FAST*

A 1250 KVA GENERAL MOTORS GENERATOR SET, Model 16-278A with *NEW* ELECTRIC MACHINERY MANUFACTURING COMPANY ALTERNATOR, 3 phase, 60 cycle, 2300 volts mounted on a fully portable, stress-relieved welded steel sub-base. All accessories are compactly mounted on steel skids to give the entire installation complete portability. The unit is designed so that it is a simple matter to erect anywhere and place in operation immediately.

900 KVA GENERAL MOTORS PORTABLE UNITS are also available. Investigate the possibilities of these compact and versatile power plants. Write for complete information today.

• ***Diesel Power Plants available from 15 to 1,000 Kw.***

Engineered AGSCO DIESEL POWER

A. G. SCHOONMAKER ESTABLISHED 1895

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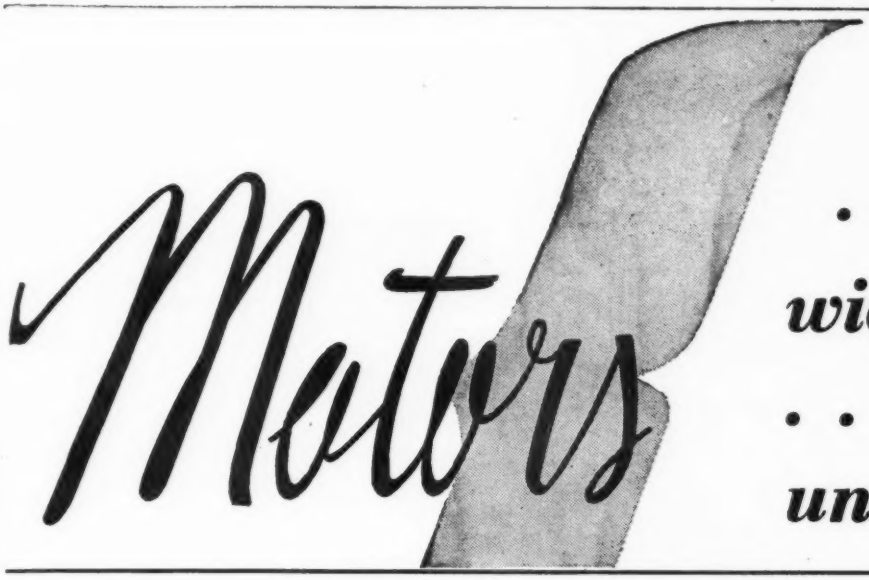


. . always a wide selection . . . always unusual values

Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE
3 Phase, 60 Cycle, 220 or 440 Volt
(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	250	G.E.	KF Vert.	3600
1	200	G.E.	K-566, 2300 Volt	720
1	250	F.-M.	HF 2200 Volt	720
1	150	Al. Ch.		1750
2	125	Ch. Wh.	126Q	430
6	125	Al. Ch.	AR, ball bearing	450
1	120	G.E.	FT	3600
3	75	F.-M.	H, ball bearing	600
1	60	Reliance	AA	900
3	50	R. & M.	L	1200
1	50	Al. Ch.	AN	900
1	50	G.E.	I 2200 Volt	900
1	50	G.E.	I	720
1	50	Wagner	BM	495
1	50	Al. Ch.		900
2	40	F.-M.	B, ball bearing	900
1	40	F.-M.		600
2	35	Al. Ch.	2 phase	900
1	35	Al. Ch.	B	900
1	30/30	West.	CS TEFCBB	1800/900
1	30	F.-M.	QZK Open BB	1200
1	30	Cr. Wh.		900
2	30	Al. Ch.	AS 2 Phase	900
1	30	Century	AS	720
1	35	Howell		1200
1	25	F.-M.	QZK B.B. New	1200
1	25	Wagner	BP	1200
1	25	Burke	EM3	900
1	25	Lincoln		900
1	25	Al. Ch.	AN	720
1	25	G.E.	M10	720
2	20	U.S.	SC SP B.B.	1800
2	20	F.-M.	QZK B.V. New	1800
1	20	West.	CS	1800
1	30	Howell	N. Vert. B.B. New	1200
1	20	F.-M.	KRV	1200
1	20	Cr. Wh.		900
1	20	G.E.	I-K 2200 Volt	900
1	20	Cleve.	M	900
1	20	Al. Ch.		900
1	18	West.	MS (Elev.)	720
1	15	F.-M.	HLS	3600
4	15	F.-M.	QZK B.B. New	1800
1	10	Al. Ch.		1200
1	10	Imperial	EH B.B.	1200
5	7½	G.E.	KT	1800
1	7½	West.	CS	1800
3	7½	Wagner	11VRW	1800
3	7½	G.E.	KT	1200
15	3	Imperial E (New)		1200

Approx. 200 New motors from 2 HP—30 HP.

SLIP RING & SYNCHRONOUS
3 Phase, 60 Cycle, 220 or 440 Volt
(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	443	El. M.	Syn.	900
1	100KW	G.E.	ATB Syn.	900
1	100	G.E.	I-16 2200 Volt	450
1	100KVA	G.E.	TRB Syn.	600
1	75	F. M.	BV 2200 Volt	1800
1	75	West.	(New) Syn.	1200
1	60	Ideal	AVX	1200
1	50	G.E.	I 25 Cycle	700
1	50	Al. Ch.		720
1	50	Ideal	AV 2200 Volt	600
1	40	West.	CW	1160
1	40	G.E.	MT	1200
1	40	Al. Ch.		1200
1	40	G.E.	MT	900
2	40	West.	CW 2200 Volt	900
2	40	West.	CW	900
2	40	Al. Ch.		900
1	40	West.	CI	730
1	40	Burke	EMV7	1150/550
1	35	Al. Ch.		720
1	35	G.E.	I-12	600
1	30	Al. Ch.	2200 Volt	720
1	25	Cr. Wh.		1200
1	25	West.	CW	720
1	25	West.	MW	720
1	25	G.E.	MT Tot. Encl.	600
1	25	G.E.	MT	400

DC—230 Volt
(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	150	West.	SK184	850
1	130	Cr. Wh.	CMC 550 Volt	1200
1	125	West.	SK	600
1	100	G.E.	CD	1200
1	100	West.	SK	1800
4	100	Cr. Wh.	CMC	225/550
1	75	Diehl	K11	700
1	60	West.	SK 115 Volt (Vert.)	1200
3	50	West.	SK	1200
1	40	Rel.	440 Volt B.B. Vert.	1800
1	40	Rel.	440 Volt B.B. (Vert.)	1200/1800
1	25/40	Cr. Wh.	CMC 440 Volt (Vert.)	1200/1800
1	40	Rel.	B. P.	400/1500
2	40	West.	SK	1200
1	40	G.E.	RC	1200
7	40	West.		775
1	35	G.E.	OMTEBB	1300
1	35	West.	SK	1200
1	35	Al. Ch.		1200
1	35	G.E.	DLC	700
2	30	El. Dy.	158	625/1250
6	30	Rel.	92TF	1800
1	30	Rel.	131 440 Volt (Vert.)	1200
1	30	G.E.	RC	1200
1	30KW	Al Ch.	110 Volt	925
1	27½	G.E.	CVC116	1800
1	25	Cr. Wh.	CM 110 Volt	900/1200
1	25	Al. Ch.	E120	500/1500
1	25	Rel.	25P	250/1000
1	25	G.E.	RF	300/900
1	25	F.M.	IRC	400/800
6	25	West.	SK	1200
7	25	West.	SK	850
2	20	Rel.	131T	1000/2000
2	20	West.	SK	750/1500
1	20	Diehl	KD	500/1000
1	20	G.E.	CD	400/1600
1	20	G.E.	RF	250/1000
1	20	Lincoln	FKW B.B.	1800
6	20	Cr. Wh.	CMC Enclosed	1800
1	20	Cr. Wh.	CMCTEBB (Exp.)	1200
1	20	Rel.	92T	1200
2	20	West.	SK	1200
1	20	West.	SK	900
1	20	G.E.	RC	900
7	20	West.	SK	750
1	20	West.	SK	500
1	15	West.	SK63	1800
1	15	West.	SK113 Encl.	1800
1	15	F.M.	D B. B.	1150
6	15	Rel.	66T	1150
2	15	Cr. Wh.	CCM	1150
1	15	Cr. Wh.	CCM Tot. Encl.	1500
1	15	West.	SK83	1150
2	15	West.	SK80L	1150
1	15	G.E.	CD	1150
1	15	West.	SK90	850
1	15	West.	KS Crane	630
8	15	Rel.	92F	850/1700
2	15	G.E.	CO Crane	650/2700
1	15	Rel.	131T 115v	600/1500
2	15	West.	SK	600/1200
1	15	Rel.	78T	400/1600
1	15	G.E.	RE11	400/1200
1	12½	West.	SK	750/1500
1	12	G.E.	RF	575/1725
1	10	West.	SK7	850/1700
2	10	G.E.	RF10	600/1800
1	10	West.	SK90	600/1800
7	10	West.	SK80L	500/1500
20	10	Al. Ch.		500/1000
1	10	Rel.	92TF	400/1000
1	10	West.	SK	250/1000
6	10	Cr. Wh.	CM TEBB	1800
1	10	Century	R304	1800
15	10	West.	SK	1150
2	10	West.	SK 115 Volt	1150
3	10	Rel.	46TF	1150
1	10	G.E.	RC9	1150
2	10	Rel.	66TF	850
2	10	G.E.	RC	850
3	10	West.	SK70	850
1	10	G.E.	RC29 550 Volt	850
1	10	Colonial		950
14	7½	West.	SK33	1750
4	7½	West.	SK601	850
20	5	West. & Gen. Elec.		1750
20	5	West. & Reliance		1150
35	5	West.	SK43	850

Hundreds of other DC motors not listed

27—New vertical, T.E.F.C.B.B., 3 Ph., 60 Cy. 220/440 volt as follows:
1—Fairbanks-Morse, 3 HP. ty. QZCU. Fr. 254, 1200 RPM Exp.
2—General Electric, 3 HP. ty. K Fr. 254, 1200 RPM
8—General Electric, 7½ HP. ty. Fr. 324, 1200 RPM
8—Delco, 7½, type C, Fr. 324, 1200 RPM
1—Howell, 7 HP. type KV., Fr. 284, 1800 RPM
5—General Electric, 15 HP. type K, Fr. 365, 1200 RPM
2—Howell, 15 HP. type KV. Fr. 365, 1200 RPM

6—New Reliance, 30 KW, variable voltage M-G sets, 250 volt DC, 220/440 volt AC, 3 phase, 60 cycle, 1800 RPM, complete with exciters, all control and drive motors. All motors ball bearing. Inclosed: M-G set, exciters and control mounted in fan cooled inclosure.

1—1000 KW, General Electric, synchronous M-G set, 4600 volt AC, 275 volt DC, condition excellent—Immediate delivery—complete data on application.

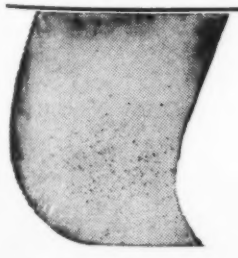
1—150 KW General Electric M-G set 250/275 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM

1—100 KW Ridgeway synchronous M-G set, 250 volt DC, 2300 volt AC, 3 phase, 60 cycle, 1200 RPM with AC control & DC panel

1—200 KW Burke synchronous M-G set, 250 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel

1—100 KW, Westinghouse, synchronous M-G set, 250 volt DC, 220 volt AC, 3 phase, 60 cycle, 1200 RPM, AC control and DC panel

6—Practically new 40 KW Reliance & General Electric variable voltage M-G sets, 250 volt DC, 220/440 volt AC, 3 phase, 60 cycle, 1800 RPM, complete with exciters all control and drive motors. All motors ball bearing, enclosed M-G set, exciters and control mounted in fan cooled enclosures. Drive motor G.E., type CD, frame 1441, 40 HP, 230 volt 400/1600 RPM, enclosed, ball bearing, 50° Cont 250 RPM, 1 hr. 50°



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PARTIAL LISTINGS—WRITE, WIRE OR PHONE YOUR REQUIREMENTS

SPECIAL—M-G SET—BARGAIN

300 H.P. Whse. synch. motor 3 ph. 25 cy. 440 V. coupled to 125 kva gen. 3/60/480 V. and 100 KW D.C. gen. type SK 125/250 V. 750 RPM

M-G SETS

KW	Mfr.	Input V	Output V
200	Gen. Elec.*	220/440 AC	125 DC
150	Cr. Wheeler*	220/440 AC	250 DC
125	Cr. Wheeler*	220/440 AC	250 DC
105	Century b.b.	220/440 AC	70 DC
100	Whse*	220/440 AC	125/250 DC
75	Star b.b.*	220/440 AC	250 DC
75	Star b.b.	240 DC	230/460 AC
75	Reliance	220/440 AC	550 DC
40	El. Prod.	220/440 AC	125 DC
35	Gen. Elec.	220/440 AC	48 DC
30	Marbie Card	220/440 AC	60 DC
30	Elec. Prod.*	220/440 AC	50 DC
25	G. E. NEW	220/440 AC	125 DC
20	Whse.	220/440 AC	250 DC
15	Gen. Elec.	220/440 AC	125 DC
9	H.V.W. 1500 Amp.	220/440 AC	6/12 DC

*Synch. motor drive.

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	230	890
75	Whse.	S13L	115	575
75	Gen. Elec.	BRC	115	1150
65	Gen. Elec.	C	230	375/750
60	Diehl dynamom.	R10	250	500/2000
40	Whse.	SK	230	750
40	Reliance	310T	230	625/1200
35/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	S-7	115	900
25	Sprague dyna.	LC	230	750/2000
25	Chand'son (4)	C13	115	850
25	G.E. b.b. NEW	CDM93	115	1150
20	Whse.	SK93	230	1150
20	Gen. Elec. (2)	RC29	230	1750
20	G.E. b.b. NEW	CDM83	115	1750
20	Gen. Elec.	RC11	115	1150
20	Reliance	T	230	850
20	Gen. Elec	LC	230	575
20	Gen. Elec.	DLC	230	500/1500
15	Gen. Elec.	RC	115	1150
15	Roth	85RS	230	1750
15	G.E. b.b. NEW	CDM67	115	1750
15	Gen. Elec.	RC10	230	1150
15	Whse. (5)	SK90	230	825
15	Gen. Elec.	CD95	230	550/1650

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	G.E. 1 brg.	MPC	125/170	1150
150	Cr. Wheeler b.b.	TEFC	250	1200
105	Century b.b.	1500a	70	1200
100	Whse. 3 wire	SK	125/250	750
75	Whse.	S	125	600
40	Whse.	SK	250	900
24	Whse.	SK	600	850
25	G.E. NEW b.b.	CD93	125	1450
20	Allis Ch.		125	475
12	Engberg b.b.	MR	250	1150
15	Gen. Elec.	RC	125	1200

A. C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Volts	Speed
300	Whse.	Synch.	2300	750
150	Whse.	C	440	500
150	Whse.	HF	440	500
50	G.E. int.	MTC5337	440	750
50	Allis Ch.	ANY	440	1500
40	G.E.	I-K	440	750
30	G.E.	KT	440	750
25	Howell	SR	440	750

A. C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
500	Allis Ch.	3 brg.	240/480	360
250	Whse.	G	2300	600
200	Gen. Elec.	ATB	240/480	900
187	El. Machy.	late	240/480	514
156	G.E. 1 brg.	ATB7558	240/480	1200
125	Whse.	G	240/480	720
100	Cr. Wheeler		2300	900
75	Triumph	A15L	240/480	900
63	El. Machy.	180 cy.	240/480	1800
60	El. Machy.		240/480	900
56	Gen. Elec.	ATB	240/480	1200
56	Gen. Elec.	ATB	240/480	900
50	Cont. b.b.	S107	120/208	1200
40	Whse. b.b.	late	220/440	900
25	Whse. b.b. (3)	1 phase	120	900
12½	Whse. b.b. NEW		240	1200

A. C. MOTORS—SLIP RING

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	400	G.E. 3 brg.	I-P	450
1—	300	G.E. 220 V.	I-M	1800
1—	300	Gen. Elec.	I-M-E16	900
1—	200	Gen. Elec.	IM-E13B	1800
1—	200	Whse. 3 brg.	HF	600
1—	200	G.E. 2200 V.	IM-15A	720
1—	125	Cr. Wheeler	SR	600
1—	100	Allis Ch.	ANY	1800
1—	100	Al. Ch. b.b. NEW	ARY	600
1—	100	Whse.	CW	720
1—	75	G.E. 2200 V.	I-M	720
1—	75	Gen. Elec.	IM-14	600
1—	75	Gen. Elec.	MT337	1800
2—	75	Gen. Elec.	I-M	720
1—	50	Gen. Elec.	MT527	1800
1—	50	Fair Morse	BV	720
1—	50	Gen. Elec. int.	ITC	600
1—	50	Whse. int.	CI	600
2—	40	Gen. Elec.	MT336	900
1—	40	Allis Ch.	ANY	450
1—	37	G.E. int.	ITC	600
1—	35	Lancashire	b.b.	1800
1—	30	Gen. Elec.	OMT336	1200
1—	30	Gen. Elec.	MT346	600
1—	30	Gen. Elec.	MT332	900
1—	25	Triumph	SR	1200
1—	25	Gen. Elec.	I-M	600
1—	20	P & H b.b. int.	WT8	1200
1—	20	Gen. Elec.	MT332	720
2—	20	G.E. int.	MTC5302	1200
1—	15	Gen. Elec.	MT502	1200
1—	15	Watson	KHV	720
1—	15	P & H b.b. int.	W7	1200

A. C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
667	Gen. Elec.	ATI	2200	450
300	Whse.	G	2200/440	600
300	Whse. 25 cycle		440	750
225	Gen. Elec.	ATI	220/440	900
150	Gen. Elec.	ATI	220/440	300
150	Gen. Elec.	ATI	220/440	600
125	Whse.	G	2300	900
125	G.E. splprf.	TS955	220/440	1200
100	American b.b.	YGH	220/440	900
75	E. Prod. b.b.	.8PF	2200	1200
75	El. Machy.	BRKT	550	900
60	Gen. Elec.	ATI	220/440	1200
60	Gen. Elec.	ATI	220/440	900

EXPLOSION PROOF MOTORS—NEW

1—3 HP 1200 RPM
2—7½ HP 1800 RPM
1—7½ HP 900 RPM
3— 5 HP 1800 RPM
1—10 HP 900 RPM
1—15 HP 1800 RPM
2—20 HP 1800 RPM

A. C. MOTORS—SQUIRREL CAGE

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	300	Gen. Elec.	KT	1800
1—	250	G.E. 2200 V.	I-K	600
1—	150	Lincoln	IU	720
1—	150	Reliance b.b. encl.	AA	900
1—	150	Fair. Morse	B	600
1—	125	Allis Ch. b.b.	AR	450
1—	125	Cont. 2200 V. b.b.	SC	1800
1—	100	G.E. b.b. NEW	K504S	1800
1—	100	Gen. Elec.	KT343	1800
1—	75	Gen. Elec.	KT337	1800
1—	75	Reliance b.b. NEW	C505	1800
1—	75	Gen. Elec.	KT329Y	3600
1—	75	Gen. Elec.	KT352	900
1—	75	Gen. Elec.	I-K	720
1—	60	Allis Ch. 4000/2200 V.	AR623	1800
2—	60	Gen. Elec.	K505	1200
1—	60	Gen. Elec.	I-K	600
1—	60	Whse. b.b. NEW	CS444S	1800
2—	60	Gen. Elec.	KT552	720
1—	50	G.E. TEFC b.b.	KF445	3600
1—	50	Whse. b.b. NEW	CS405S	1800
2—	50	Gen. Elec.	KT552	600
1—	50	G.E. 2 phase	I-Q	900
2—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C445	1200
2—	50	Gen. Elec.	KT336	1200
1—	50	Gen. Elec.	KT342	900
2—	50	Whse. vertical	CS766	900
1—	40	G.E. NEW	K404	1800
1—	40	Howell b.b	SC	1800
1—	40	Al. Ch. 3 speed	ARX	900/600/450
1—	40	Gen. Elec.	I-K	1200
5—	40	Gen. Elec	KT336	900
2—	35	Gen. Elec.	I-K	720
2—	30	Howell b.b. 4 speed	SC	1800
2—	30	G.E. NEW bb.	K365	1800
2—	30	G.E. NEW hitorq	KG365	1800
2—	30	Whse. NEW b.b.	CS405	1200
2—	30	G.E. TEFC b.b.	K404	1800
1—	30	Gen. Elec.	I-K	900
1—	30	Gen. Elec.	KT336	720
1—	30	Wagner	22T8P	900
1—	30	Whse.	CS646	900
2—	30	Reliance TEFC NEW	C444	1200
5—	25	Reliance b.b. NEW	C364	1800
2—	25	Reliance TEFC NEW	B365	1800
2—	25	Reliance b.b. NEW	C404	1200
2—	25	Reliance TEFC NEW	C405	1200
2—	25	Whse. NEW spl. b.b.	CS365	1800
1—	25	Gen. Elec.	IK	1200
1—	25	Allis Ch.	AN	1200
3—	25	Whse.	CS646	900
2—	25	Gen. Elec.	I-K	600
1—	20	G.E. TEFC b.b.	K404	1200
1—	20	U.S. NEW b.b.	SC326	3600
1—	20	Gen. Elec.	KT182	3600
4—	20	Relance b.b. NEW	C364	1800
2—	20	L.A. NEW exp. prf.	EX364	1800
2—	20	Whse. NEW b.b. spl.	CS364	1800
2—	20	Gen. Elec.	KT312	1200
2—	20	Gen. Elec.	I-K	1200
1—	20	Whse.	CS	1200
1—	20	Gen. Elec. b.b.	I-K	900
1—	20	Fair. Morse	BH	900
2—	20	G.E. NEW b.b.	K365	1200
2—	20	Diehl TEFC NEW	INF364	1800
2—	20	Century b.b. 4 speed	SC594	1800
2—	15	Whse. TEFC NEW	CS365	1200
4—	15	G.E. NEW b.b.	K324	3600
2—	15	Diehl NEW b.b.	D1326	1800
2—	15	Whse. NEW TEFC	CS326	1800
1—	15	Diehl. TEFC NEW	INF365	1200
2—	15	Gen. Elec.	KT954	1800
1—	15	G.E. spl. b.b.	K365	1200
4—	15	Gen. Elec.	KT302	1200
1—	15	Gen. Elec.	KT512	900
1—	15	L. Allis	OX365	900

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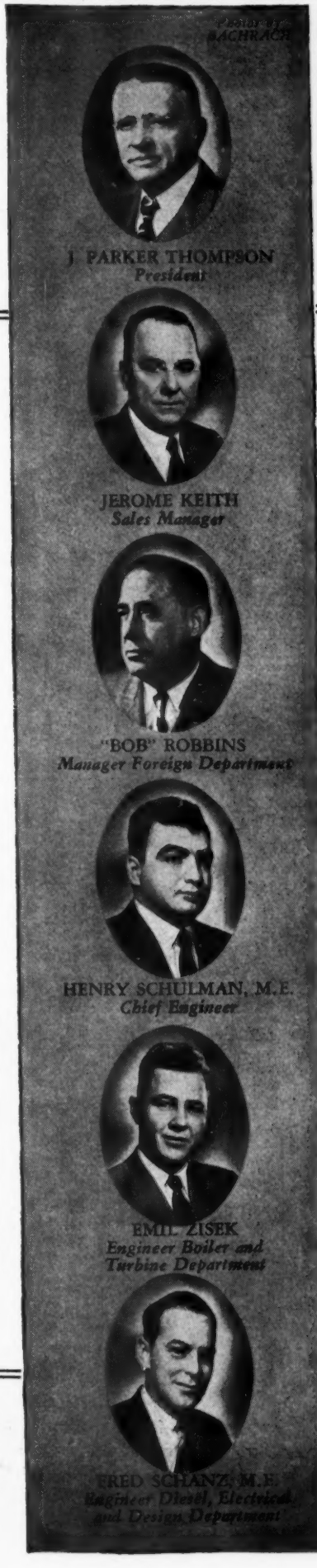

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1— 60 HP Erie City Econ., 100#
1—100 HP Erie Econ., 100#
1—102 HP Ames Empire, 125#
2—107 HP Kewanee, 125#
1—150 HP Erie City Econ., 150#
2—250 HP Kewanee, Ser. 500, 125#

BOILERS—SCOTCH

1— 75 HP O & S Scotch, 100#
2—100 HP Hodge, 125#
1—125 HP Leffel Scotch, 125#
2—130 HP Hodge, NEW, 140#
1—300 HP Titusville, NEW, 125#

BOILERS—LOCOMOTIVE

1— 90 HP Fitzgibbons, 100#
1—100 HP Farrar & Tr., 300#
2—125 HP Oil Well, 300#

BOILERS—H.R.T.

1—125 HP Titusville, 125#
2—165 HP Bigelow, 125#
4—200 HP Portland, 125#

BOILERS—WATERTUBE

1—250 HP Heine, 150#
1—253 HP B&W Stirling, 180#
2—300 HP Oil City, 160#
1—300 HP Wickes, NEW, 200#
1—304 HP Heine, 175#
1—330 HP Badenhausen, 100#
2—400 HP Heine, 200#
1—400 HP Walsh-Wid., 300#
1—434 HP Heine, 200#
1—498 HP B&W Stirling, 160#
1—508 HP B&W Sec. Header, 200#
2—100 HP B&W Stirling, 425#

DIESEL GENERATORS—A. C.

1—1000-KW G.M.-Wsthgse 2300-V.
3— 800-KW Hamilton-Wsthgse 2300-V. NEW
1— 290-KW G.M.-Wsthgse 250-V.
1— 250-KW Busch-Sulzer-G.E. 2300-V.
1— 200-KW Fairbanks-Morse 440-V.
3— 200-KW G.M.-Wsthgse 440-V.
2— 100-KW G.M.-Westhgse 220-V.
8— 100-KW G.M.-Wsthgse 400-V.
1— 75-KW Cat.-G.E. 127/220-V.
2— 70-KW Coop-Bess.-G.E. 450-V.
2— 60-KW G.M.-G.E. 127/220-V.
2— 50-KW Cat.-Elect. Mach. 120/208-V.
3— 50-KW Murphey-Elect. Mach. 120/208-V.
2— 30-KW Cat.-G.E. 240-V.
9— 30-KW International 230/400-V. NEW.
8— 20-KW International 230/400-V. NEW.
9— 15-KW International 120/208-V. NEW.
8— 12-KW International 120/208-V. NEW.
6— 10-KW International 230/400-V. NEW.
2— 5-KW Palmer 120/230-V. NEW.

TURBOGENERATORS—A. C.

1—6000-KW G.E. Cond 2300-V.
2—4000-KW G.E. Cond. 2300-V.
1—4000-KW Wsthgse Cond 2300-V.
1—3500-KW G.E. Cond. 2300-V.
2—3000-KW G.E. Cond. 2300-V.
1—2500-KW Wsthgse Cond 2400-V.
2—2500-KW Wsthgse Cond 2300-V.
1—2000-KW All Chal. Cond 480-V.
1—2000-KW G.E. Cond 2300-V.
2—1500-KW G.E. Cond 6600-V.
4—1500-KW Elliot Cond 2300-V.
4—1500-KW G.E. Cond 2300-V.
1—1400-KW All. Chal. Cond 2300-V.
5—1250-KW G.E. Cond 2300-V.
2—1250-KW All. Chal. Cond 2300-V.
2—1250-KW G.E. Non-Cond 2300-V.
1—1000-KW All. Chal. Cond 480-V.
1—1000-KW Wstghse Non-Cond 2400-V.
2—1000-KW DeLaval Non-Cond 4150-V.
2—1000-KW Wsthgse. Cond 2300-V.
1—1000-KW DeLaval Cond. 4150-V.
2—1000-KW G.E. Cond. 2300-V.
2—1000-KW All. Chal. Non-Cond 2300-V.
1— 750-KW All. Chal. Non-Cond 480-V.
1— 750-KW Terry Non Cond 440-V.
1— 750-KW G.E. Cond 480-V.
1— 750-KW All. Chal. Cond 480-V.
2— 600-KW G.E. Cond 440-V.
1— 500-KW Wsthgse Non-Cond 480-V.
1— 500-KW G.E. Non-Cond 2300-V.
1— 250-KW G.E. Cond 450-V.
3— 250-KW Wsthgse Cond 450-V.
1— 200-KW Wsthgse Cond 450-V.

ENGINE GENERATORS—A. C.

1—285-KW Chause-Cr. Wheel. 240-V.
2—250-KW Skinner-All. Chal. 2300-V.
2—200-KW Skinner-G.E. 2300-V.
1—200-KW Ames-Cr. Wheel. 480-V.
1—200-KW Skinner-G.E. 480-V.
1—200-KW Ames-Burke 250-V.
1—160-KW Ames-Cr. Wheel. 240-V.
1—150-KW Ames-G.E. 440-V.
1—100-KW Ball-Wsthgse 240/480-V.

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ELECTRICAL AND POWER EQUIPMENT

M-G SETS—ROTARIES
(3 ph. 60 cy.)

500 KW 250 v. G.E. Rotary 514 RPM—6600/4000 v. Trans.
500 KW 250 v. West.—714 HP Syn. .8 P.F.
500 KW 250 v. G.E.—700 HP Ind. G.E.
300 KW 250 v. G.E. 600 RPM Rotary Bare.
300 KW 250/125 v. con. 2—150 KW West. SK 125 v. Gen. Dir. con. 450 HP Motor.
300 KW 250 v. West.—450 HP 35% LPF 440 v. (Motor can be rewound for 2300 v.)
150 KW West. 125 v.—250 HP Ind. 2200 v.
100 KW 125 v. Burke—150 HP Syn. 2200 v.
100 KW 250 v. G.E.—150 HP Ind. West.
90 KW 60 v. West.—135 HP Ind. West.
75 KW 250 v. Star—125 HP Syn. Star
75 KW 75 v. West.—100 HP West. Ind.
50 KW 125 v. G.E.—75 HP G.E. 2200 v.
40 KW 250 v. West.—60 HP West. Ind.
32 KW 250 v. West.—50 HP West. Ind.
15 KW 125 v. Wotten—25 HP 220/440 v.
10 KW 125 v.—15 HP Master 220/440 New.
7½ KW 250 v. West.—15 HP West. Ind.

AC & DC GENERATORS

3½ KW 250 v. G.E. RC27A 1150 RPM
9 KW 125 v. West SK 80 L 900 RPM
25 KW 125 v. SK 120 L West 1150 RPM
45 KW 250 v. S West. 1000 RPM
60 KW 60 v. 1000 amp. West SK Welding
2—150 KW West. SK 125 v. 1200 RPM
500 KW G.E. 250 v. 900 RPM cp. Int.
300 KW West. 125/250 v. 1200 RPM
1250 KVA West. 450/3/60 1200 RPM New.

AC MOTORS
(3 ph. 60 cy.)

HP	Make	Wdg.	Spd.	Type
1400	West.	Syn.	1200	1 P.F.
1000	West.	Syn.	1200	.8 P.F.
750	West.	Syn.	1200	.7 P.F.
600	G.E.	S.R.	900	MT
450	G.E.	S.R.	257	IM
435	G.E.	Syn.	450	ATI
400	G.E.	S.R.	900	IM
300	G.E.	S.R.	450	IM
300	West.	S.C.	900	CS
300	West.	S.R.	1750	CW
250	Al. Ch.	S.R.	600	
185	West.	S.R.	720	CW
125	West.	Syn.	277	
80	G.E.	S.R.	900	MTC
75	West.	S.C.	690	CS
75	G.E.	S.R.	600	IM
50	West.	S.R.	600	CW658 D
50	G.E.	S.R.	900	IM
50/12½	G.E. 2200v.	S.R.	900/450	IM
25	West. 550v.	S.C.	1750	CS 365
25	Cr. Wh.	S.R.	580	1210
15	L.A. TEFC	S.C.	3600	JX324
15	G.E.	S.R.	1710	MT 501
25	G.E. Vert.	S.R.	1200	MT336Y
10(6)	West.	S.C.	1160	CS 284
10	West.	S.C.	860	CS 464 C
10	West.	S.C.	570	CS 566 C
7½	West.	S.C.	1750	CS 284
7½	West.	S.C.	3470	CS 254Y
7½	West.	S.C.	860	CS
5	West.	S.C.	1160	CS

ANNOUNCEMENT

The Moorhead - Reitmeyer Co., 30th & Brereton Sts., Pittsburgh, Pa., has changed its name to The Moorhead Electrical Machinery Co.

There is no change in ownership or personnel and the Moorhead Electrical Machinery Co. will continue in the business of buying and selling Power and Mining Equipment with offices at 30th and Brereton Sts., Pittsburgh, 19, Pa. (Also warehouse at Oakdale, Pa.)

Wm. L. Moorhead, who established the business in 1919, will continue as President of the Moorhead Electrical Machinery Co.

AIR COMPRESSORS

1100 cu. ft. 100# pres. Chic. Pneu. 2 stage dir con. 215 HP West. Syn. Motor
750 cu.ft. 100# pres. Chic. Pneu. 2 stage Type OCE 17 & 10 x 12"
356 cu.ft. 100# pres. Chic. Pneu. 12 x 10
245 cu.ft. 100# pres. Ing. Rd. ER1, 10 x 10
175 cu.ft. 100# Pres. Chic. Pneu. 9 x 8
164 cu.ft. Ch. Pneu. Steam Type
75 cu.ft. 100# Pres. Ing. Rd. ER1

ENGINE & TURBINE UNITS

50 KW West.—Turbo 125 v.
75 KVA G.E. 110/220/440/3/60 1200 RPM G.E. Diesel Eng., auto. control.
300 KW West. 125/250 v. DC—West. Turbine 440# Pres.
500 KW 250 v. G.E. 900 RPM—Terry Mixed Pres.

SYN. CONDENSER

1250 KVA West. Unused 3 ph. 60 cy. 1200 RPM now 440 v. but can be rewound.

AC MOTORS
(3 ph. 25 cy.)

HP	Make	Wdg.	Spd.	Type
300*	G.E.	S.R.	375	MT 415
100	G.E.	S.R.	500	MI-108

* Can be furnished with control.

DC MOTORS

HP	Make	Voltage	Wdg.	Speed
2/3.75	West. SK 225	230	sh.	1610/1200
3	West. SK 23	230	sh.	1150
4½	G.E. RC 27A	230	sh.	750
5	West. SK 20	115	sh.	1750
5	Rel. 14T	230	sh.	1750
7½	West. SK40	115	sh.	1150
7½	West. SK60	230	cp.	850
7½ (2)	West. SK83	230	cp.	1050 Enc.
7½	West. SK43	230	sh.	1150
10	West. SK 43S	115	sh.	1750
7½	Al. Ch.	230	sh.	350/1050
10	West. SK 60L	230	sh.	1150
10	G.E. CD	230	sh.	1750
10	West. SK 80	230	sh.	730/1460
10	Cr. Wh.	230	sh.	500/1500
13	West. SK 113	230	sh.	875
15	West. SK 110	230	cp.	750
15	West. SK 83	230	cp.	950
15	Cr. Wh. CM	230	sh.	1400/1700
20	Cr. Wh. CMC	230	sh.	1200/1700
20	G.E. DLC	500	sh.	400/1200
20	West. SK 110	230	sh.	900
25	West. S	230	sh.	325/975
25	West. K5	230	ser.	500
25	West. SK 113	230	cp.	900
30	West. SK 93	230	sh.	1750
40	G.E. RC 34	230	sh.	750
50	West. S	230	cp.	875
60	West. SK 123L	230	sh.	1750
60	Rel. T461	230	sh.	800/1200
100	Rel.	230	sh.	400/1000
125	West. SK 193	230	sh.	450/1000
200	Rel.	230	sh.	400/1200
375	West.	230	cp.	430/860
500	G.E. MPC	230	cp.	160/250

DC MAGNETIC MOTOR STARTERS

5—10 HP 230 v. Mag. Rev. Dyn. Braking
1—25 HP C.H. 230 v. Dripproof.
4—30 HP EC & M. 230 v. Magnetic.
3—40 HP 230 v. W.L. Dripproof.
1—50 HP 230 v. C.H. Dripproof.
4—60 HP 230 v. C.H. Dripproof.
4—60 HP 115 v. W.L. Dripproof.
4—75 HP 230 v. C.H. Dripproof.
1—100 HP 230 v. C.H. Dripproof.
1—150 HP C.H. 230 v. Dripproof.

REDUCTIONS UNITS

500/700 HP Morse Chain Drive. 4.28 to 1.
400 HP Falk Unit 4.143 to 1 Ratio.
300 HP V Belt dr. pulleys 30" and 48" supported by 2 roller bgs. with pedestals.
250 HP Falk Unit 12½ to 1 Ratio.
150 HP Nuttall 1.6 to 1.
150 HP G.E. Unit ratio 3 to 1.

AC MAGNETIC STARTERS

6—43¼ Clark Mche. Tool Mag. 440 v. 25 cy. 3 ph.
2—700 HP. West. 2200 v. Syn. Line Starters. 3/60

Power Equipment Engineers for Over a Quarter Century

MOORHEAD ELECTRIC MACHINERY CO.

30th and Brereton Sts. **Pittsburgh 19, Pa.**

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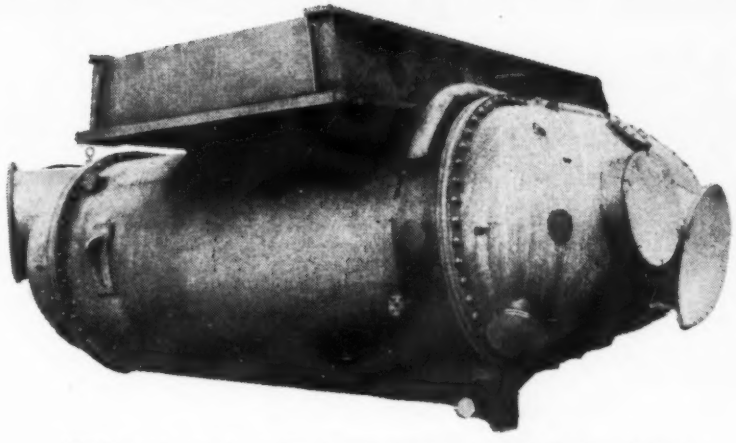

3800 sq. ft. Surface Condenser Copper Nickel Tubes. NEW

TURBO-GENERATORS—A. C.

6—300 KW G.E. type ATI 3/60/450, 1200 RPM cond., compl. with 40 KW exciters, condensers, switchboards.

2—200 KW Westinghouse, 3/60/450, 1200 RPM cond. (NEW).

8—200 KW, G.E. type ATB 3/60/450, 1200 RPM cond. and non-cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

TURBO-GENERATORS—D. C.

KW	Volts	Winding	Speed	Type
2—375	180/240	Shunt	1200	non-cond.
12—150	120	Shunt	1200	cond.
20— 60	120	Stab. Sh.	1800	cond.
3— 25	120	Stab. Sh.	1200	cond.

HYDRAULIC PUMPS

5—Vertical, quintuplex, 4⅜ x 10, 450 gpm at 128 RPM against 2500 p. s. i., mfd. by Aldrich driven by 700 HP synchr. motors 3/60/2300.

BOILERS

10—Cleaver-Brooks, 2000# steam pr. hr. 35# press.

6—Cyclotherm 3000 pounds steam per hour, 125# press.

6—Express Boilers, modified D type, Foster Wheeler 30,000# steam/hr., 435# press., with economizers, superheaters, desuperheaters, oil burners, etc.

8—B&W, D type, 580# press., 5400 sq. ft. heating surface.

DISTILLING PLANTS

2—40,000 gallons per day, Foster Wheeler triple effect low pressure

1—80 tons per day, Condenser Service, double effect.

10—2000 gals. per day Kleinschmidt vapor compression distiller mfd. by Badger.

1—750 gals. per day, same as above.

CONDENSERS—ALL NEW

3—14750 sq. ft.—262500 # steam/hr.
1— 9533 sq. ft.— 58000 # steam/hr.
10— 3800 sq. ft.—w/L.P. Heater and air ejector
2— 1050 sq. ft.—designed for 600 KW turbines
10— 400 sq. ft.—6400 # steam/hr.
8— 155 sq. ft.—with double end steam pumps
10— 206 sq. ft.—H.P. feed heaters

MOTORS

3 Ph. 60 Cy.

6—3800 HP 1700 V 257 RPM G.E.
5— 700 HP 2300 V 128 RPM
2— 350 HP 2300 V 590 RPM West.
15— 200 HP 2300 V 705 RPM G.E.

D. C.

1500 HP 525 V DC 600 RPM W'hse

GENERATORS

1200 KW 525 V DC 750 RPM All. Chalm.
1075 KW 375 V DC 750 RPM Elliott
700 KW 240 V DC 500/720 Elliott
540 KW 240 V DC 1200 RPM West.
100 KW 120/240 1200 RPM Delco

REDUCTION GEARS

4—1800 HP 2.41:1 10—20 HP 41:1
10— 900 HP 2.48:1 10—11 HP 39:1
10— 25 HP 20:1 10—10 HP 1750:63
7—Waterbury hydr. type K, size 35, 5 and 2A

HOISTS

10—100,000# pull at 10 FPM to 3000# pull at 400 FPM, 2 Gypsies 12000# pull at 125 FPM, driven by 50 HP 230v. D.C. motors 525—1800 RPM.

15—15,000# pull at 78 FPM, 3360# pull at 348 FPM and 2 auxiliary drums. Driven by Chrysler 28.35 H.P. gasoline engines. (NEW).

DIESEL ENGINES

	Make	Model	H.P	R.P.M.	Cycles	Cylinders	Bore & Stroke	Year	Reverse & Reduction Gear
4	General Motors	16-258S	1800	900	4	16	9½"×12"	1943	2.41:1 (fluid coupling)
2	Hamilton	R.B. 99-D.A.	1600	700	2	9	9⅛"×13⅜"	1944	
8	Fairbanks Morse	38D O/P	1600	720	2	10	8⅛"×10"	1944	Reversible. Hydr clutch
8	General Motors	16-278A	1600	720	2	16	8¾"×10½"	1944	
4	General Motors	12-278A	1200	750	2	12	8¾"×10½"	1944	Falk 2.5:1
35	General Motors	12-567ATL	900	744	2	12	8½"×10"	1942-44	Falk 2.5:1
2	General Motors	8-268A	500	1200	2	8	6½"×7"	1943	2.54:1
2	Fairbanks Morse	38 O/P	300	1200	2	6	5"×6"	1936	
20	General Motors	6-71	225	2100	2	6	4¼"×5"	1944	
4	Buda	6LD468	95	1850	4	6	4¼"×5½"		

Ask For Our Complete 1948 CATALOG

DIESEL GENERATOR SETS—A. C.

									KW	Volts	Cycles	Phase	Exciter KW	Exciter Volt
3	General Motors	8-268A	350	1200	2	8	6½"×7"	1943	200	440	60	3	40	120/240

DIESEL GENERATOR SETS—D. C.

7	General Motors	16-278A	1600	750	2	16	8¾"×10½"	1943	1200	525	Allis Chalmers Type MHC 2290 AMPS
4	General Motors	12-278A	1200	750	2	12	8¾"×10½"	1943	1200	240	Elliott
2	General Motors	8-268A	500	1200	2	8	6½"×7"	1944	375	120/180/240	Westinghouse
50	Superior	GDB-8	150	1200	4	8	5½"×7"	1942-44	100	120/240	Delco 3 wire stab. shunt 60° C rise
4	General Motors	3-268A	150	1200	2	3	6½"×7"	1943-44	100	120/240	Allis Chalmers 3 wire stab. shunt
1	Caterpillar	D3400	26	1500	4	4	3¾"×5"	1942	15	120/240	G. E. Model 52A1990 compd. wd.

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HUGO NEU CORPORATION

31 Nassau Street New York 5, N. Y.

Tel. REctor 2-1334

ARRANGE FOR INSPECTION

"BREW, WOLTMAN OFFERS"

TURBINE UNITS—60 Cy.

2—6250 KW Gen. Elec. 25 Cycle, Cond.
1—4000 KW General Electric Cond.
2—3750 KVA Westinghouse Cond.
1—3125 KVA General Electric Cond.
1—2000 KW General Electric Non-C.
1—1600 KW General Electric Cond.
2—1250 KVA General Electric Cond.
2—1250 KVA Elliott Cond.

STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—450 KVA Ames Uniflow
1—375 KVA Harrisburg Uniflow
1—312 KVA Murray Corliss
1—225 KVA Skinner Uniflow
1—187 KVA Ames Vertical
1—156 KVA Ames Vertical
1—150 KVA Harrisburg 4-valve
1—125 KVA Ames Uniflow

D.C. STEAM ENGINE UNITS

1—600 KW Skinner Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.
1—275 KW Ames Uniflow, 250 V.
1—200 KW Skinner Uniflow, 250 V.

DIESEL ENGINE UNITS

6—1600 HP Fair. Morse, 2400 V. 60 cy. gen.
3—1200 HP Hamilton 2300/4000 V. 60 cy. gen.
1— 720 HP Amer. Loco., 2400 V. DC
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 480 HP Fair. Morse, 2400 V. 60 cy. gen.
1— 400 HP Fair. Morse, 2300 V. 60 cy.
1— 400 HP DeLaVergne 2400 V. 60 cy.
1— 90 HP Fair. Morse, 240 V. 60 cy.
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.

WATER TUBE BOILERS

2—748 HP Edgemoor 250-lb. Stokers
1—519 HP Titusville 200-lb. Stoker
6—509 HP Heine, 200-lb. Stokers
5—492 HP Heine, 180-lb. Stokers
2—469 HP B. & E. 425-lb. Pulverizer

SYNCHRONOUS MOTORS

1—6000 HP G.E. 60 cy. 2300 V. 90 RPM
2—2000 HP West. 60 cy. 2200 V. 120 RPM
1— 880 HP G.E. 60 cy. 6600 V. 514 RPM
1— 500 HP G.E. 60 cy. 2200 V. 720 RPM
1— 350 HP G.E. 60 cy. 2200 V. 720 RPM
1— 300 HP G.E. 60 cy. 2200 V. 600 RPM
1— 300 HP West. 60 cy. 2300 V. 900 RPM
1— 200 HP West. 60 cy. 440 V. 1800 RPM
4— 150 HP West. 60 cy. 2300 V. 400 RPM
1— 100 HP G.E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS

1—8000/1000 HP Cr. Wh. S/R 2200 V. FL 895/448 RPM
1—1200 HP Allis Chalmers S/R 2200 V. 440 RPM
1—1000 HP West. S/R 2200 V. 360 RPM
1— 800 HP Allis Chalmers S/R 2200 V. 440 RPM
3— 350 HP Elliott S/C 2300 V. 900 RPM
1— 300 HP West. S/R 2200 V. 1800 RPM
1— 200 HP G.E. S/R 2200 V. 435 RPM
1— 150 HP Cr. Wh. S/C 440 V. 1800 RPM. NEW.
1— 150 HP Burke S/C 440 V. 1800 RPM. NEW.
1— 150 HP Al. Ch. S/C 440 V. 1200 RPM
1— 60 HP West. S/C 2300 V. 1200 RPM

MOTOR GENERATOR SETS

1—1500 KW Allis Chal. 600 V. DC 60 cy.
2—1000 KW Gen. Elec. 600 V. DC 60 cy.
1—1000 KW Gen. Elec. 275 V. DC 60 cy.
1— 750 KW West. 250 V. DC 60 cy.
1— 500 KW Cr. Wh. 600 V. DC 60 cy.
1— 400 KW Allis Chal. 275 V. DC 25 cy.
2— 300 KW Allis Chal. 275 V. DC 25 cy.
1— 300 KW West. 250 V. DC 60 cy. 3 wire
2— 200 KW Cr. Wh. 250 V. DC 60 cy.
1— 200 KW Gen. Elec. 60 V. DC 60 cy.
2— 150 KW Elec. Mcy. 250 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.
1— 50 KW West. 125 V. DC 60 cy.

ROTARIES—60 Cy.

1—2000 KW Allis Chalmers 600 V.
2—1000 KW Gen. Elec. 600 V.
1—1000 KW Westinghouse 240 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW Gen. Elec. 600 V.
1— 500 KW Allis Chalmers 600 V.
1— 500 KW General Electric 275 V.
2— 300 KW Westinghouse 250 V.

FREQUENCY CHANGERS

1—6250 KVA G.E. 50/60 cy. 600 RPM
1—2150 KVA G.E. 25/62½ cy. 750 RPM
1—1875 KVA G.E. 25/60 cy. 200 RPM
1—1200 KVA G.E. 25/60 cy. 300 RPM
2—1000 KVA G.E. 25/60 cy. 300 RPM
1— 500 KVA West. 25/62½ cy. 750 RPM

TRANSFORMERS—60 Cy.

3— 833 KVA Al. Ch. 33000-4800 V.
3—3750 KVA West. 26400/13200-2400 V.
1—8000 KVA Penn. Auto 26400/13200-2400 V. 3 ph.
4— 333 KVA Al. Ch. 25410/44000-13280/23000 Y
2—1000 KVA G.E. 23000-11500-575 V.
3— 750 KVA West. 22000-2300/4600 V.
3— 134 KVA G.E. 14400-2400 or 480 V.
2—1000 KVA G.E. 11500/23000-575 V.
3— 167 KVA G.E. 7200/12400 Y-2400 or 480
1—1500 KVA West. Auto 4000-2300 V. 3 ph.
3— 167 KVA G.E. 2400/4160 Y-120/240 V.
1—2500 KVA West. 2400-480 V.
1— 100 KVA G.E. 2300-575 V.
3— 20 KVA West. 2200-575/287½ V.

OIL CIRCUIT BREAKERS

1—	400 A. 37 KV West G11	Outdoor
2—	400 A. 25 KV G.E. FK0136	Outdoor
2—	1000 A. 23 KV Kelman CB76	Outdoor
2—	600 A. 15 KV G.E. FK255	Indoor
4—	600 A. 15 KV FHK0139-24BS	Outdoor

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50 Church Street New York City 7, New York

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Special Offerings

TURBO-GENERATORS

1—3500 KW 2300 V Cond.
2—2500 KW 440 V Cond.
1—3000 KW 600 V Cond.
1—2000 KW 600 V Cond.
2—1250 KW 2300 V Cond.
1—1500 KW 2300 V Cond.
2—1000 KW 440 V Extrac.
1—1000 KW 2300 V Cond.
1— 500 KW 440 V Cond.
2— 125 KW 220/440 V N.C.
1— 250 KW 2300 V N. D.
1— 125 KW 600 V Extrac.
1— 50 KW 220 V AC. N.C.

ENGINE GENERATORS

1—375 KW 2300 V Uniflow
1—168 KW 600 V.
2—280 KW 480 V.
1—250 KW 480 V.
1—150 KW 180 V.

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#

BOILERS

2—30,000# 425 PSI
1—1030 HP 225#
1— 500 HP 400#
4— 500 HP 200#
2— 480 HP 225#
2— 400 HP 180#
1— 250 HP 180#
2— 175 HP 200#
1— 150 HP 150#
1—100 HP 133# Scotch
1— 75 HP 150# New
1— 50 HP 200#

AIR COMPRESSORS

1—6000 CFM 50# Motor
1—2700 CFM 100# Motor
1— 700 CFM 100# Belted
1—5000 CFM 10# Rotary Type 440 V Syn. Motor
1—6000 CFM 5.1# New

TRANSFORMERS

3—200 KVA 600/220/110
3—1250 KVA 6600/600 V

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

The Buyers Must Be Satisfied—Always

LIGHT PLANT

International Model UD14 diesel generator set. 4 cyl. with electric starter and radiator. Direct connected 25 KW, 900 RPM, 1/60/220 generator with exciter, voltage regulator, rheostat. Standard factory unit. Condition like new. Price $1300.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis, Mo.

STEAM TURBO UNIT

60 CYCLE

For Immediate Delivery

1—3000 K.W., 3750 KVA. Westinghouse CW 46, 2 Stage Reaction Type Single Flow Condensing Turbo 150/200# steam pressure, Alternator 3 phase, 60 cycle, 2300 volts, 3600 RPM.

Unit recently entirely overhauled by manufacturer.

ARCHER & BALDWIN, INC.
(Inc. 1917)
75 West Street, New York, 6, N. Y.

NEW AC MOTORS

3/60/220/440 VOLTS

Quan.	HP	Speed	Remarks
3	½	1200	220 V.-T.E.
1	½	1800	T.E.N.V.
3	1	1200	T.E.
1	1	1200	X.P.
1	1	1800	220 V.-X.P.
2	1½	1200	T.E.
3	1½	1800	T.E.
1	1½	1800	X.P.
2	1½	3600	T.E.
6	2	1200	T.E.F.C.
1	2	1800	X.P.
1	2	1800	Open
3	2	3600	T.E.F.C.
2	3	1200	X.P.
2	3	1800	T.E.F.C.
3	3	3600	T.E.F.C.
1	5	1200	X.P.
6	5	1200	T.E.F.C.
1	7½	1200	T.E.F.C.
1	7½	1200	X.P.

1/60/110/220 VOLTS

7	1	1200	T.E.
3	1½	1800	X.P.
1	2	1200	Open
1	3	1800	Open

NEW GEAR MOTORS

3/60/220/440 VOLTS

Quan.	HP	Output RPM	Remarks
1	¼	96	440 V.-Open
1	¼	72	Open (1/60/110 Volts)
1	⅓	72	440 V.-Open
1	½	86.2	Open
1	½	290	Open
1	1	45	Open
1	2	98.9	Open

COMPLETE BOILER PLANT

45,000 lbs. per hour capacity

1—Erie City Water Tube Boiler, 45,000 lbs. per hour capacity, ASME Code and National Board stamped, 180 lbs. pressure, 3 drums; pulverized coal fired with type C Unitype Pulverizer; feed waterheater; steam driven boiler feed pump. Steel coal bin for 275 ton storage and Bucket Elevator 46' centers.
In addition there is an Erie City Unitype Pulverizer, size A, for use at low loads 1250# capacity/hour, driven by 30 H.P. Westinghouse Motor 3/60/440 volts. This unit can be purchased with or without the additional pulverizer.

EXCELLENT CONDITION—ALMOST NEW

DIESEL LOCOMOTIVES

1—45 Ton Diesel Electric Locomotive, Mfg. General Electric-Cummins. Standard gauge.
1—45 Ton Diesel Electric Locomotive, Mfg. General Electric-Cooper Bessemer. Standard gauge.

REDUCERS

2—Cleveland, Worm Gear, size 400 AH, ratio 3-5/9—1.
2—Cleveland, Worm Gear, size 400 AH, ratio 4-5/6—1.
1—Cleveland, Worm Gear, size 200 AH, ratio 5-4/5—1.
1—Cleveland, Worm Gear, size 100 AH, ratio 5-3/5—1.
1—Cleveland, Worm Gear, size 100 AH, ratio 50—1.
1—Philadelphia, Worm Gear, size 370 M2, ratio 41.27—1.
1—Philadelphia, Worm Gear, size 369 R2, ratio 67—1.
4—Philadelphia, Worm Gear, size OOAT, ratio 5-1/6—1. New.
1—Philadelphia Worm Gear, size 1075, ratio 24½—1. Vertical. New.
1—DeLaval, Worm Gear, size AW 600, ratio 14½—1.
1—Farrell-Birmingham, Herringbone, size SR 9, Ratio 10—1.
1—D. O. James, size 81, ratio 6—1.

AIR CONDITIONING UNITS

1—Frigidaire Compressor Model FE 102, nominal capacity 20 tons with EC-202 Evaporative Condenser, #3052-F3 and #3052-F4 Freon cooling coils. Powered by 20 H.P., 3 Phase, 60 cycle, 220/440 volt, 1770 RPM Motor.
1—30 ton Carrier Air Conditioning Unit consisting of two—2 cylinder Compressors and two—15 H.P. Motors mounted on common base; with Kathabar Unit complete with oil accessories, starters and instruments. Electrical characteristics 3/60/220/440. New 1942. Has been in use one season.

AIR COMPRESSOR

1—Ingersoll-Rand Compressor Type 40, 7" & 6¼" x 5" delivering 156 CFM at 100# with 40 H.P. Gen. Elec. TEFC motor, 3/60/220/440 volt, 900 RPM and Control.

PUMPS

1—Duriron Pump, size 3" x 2", #403, type D3MG—10½—104, w/motor.
2—Duriron Pumps, size 2" x 3", Type DG 10½—112, w/motors.
1—Duriron Pump, size 1½" x 2", Type D2MC 6¼, w/motor.
3—Duriron Pumps, #403, size 4" x 3", #403, complete with motors.
3—Gould 250 GPM 30' head, 4" suction, 4" discharge, w/o motor.
1—Gould 400 GPM 280' head direct connected to 50 HP 3/60/440 volt motors.
1—Worthington monobloc size 4 DE 5, driven by 15 HP 3/60/220/440 volt motor.
6—Westco Turbine Type Pump BR 630 series E size 2½" 80 GPM 50' head, or 25 GPM 250' head, driven by 5 HP 3/60/220 volt motors.
1—Ingersoll-Rand 6 ALV 2000 GPM 188' head w/o motor.
1—Peerless Deep Well Turbine Pump 500 GPM 138' head driven by 25 HP 3/60/440 volt motor.
1—Morris Machine Works Boiler Feed Pump 4" four-stage 350 GPM driven by 100 HP Curtis Steam Turbine.

Heat and Power Co., inc.

70 PINE STREET | DIGBY 8-0373 | NEW YORK 5, N. Y.

MOTOR GENERATORS

Brand new. Built by Allis Chalmers to rigid specifications of the U. S. Navy

K.V.A. output 1,250 R.P.M. 3600
K.W. output 1. Cont. Duty Ph. Single
P.F. 80 Cycles 60
Volts input 115 D.C. Volts output 120 A.C.
Amps input 14 Amps output 10.4
Length 26"; width 12⅞"; height 13"
Compound accumulative A.C. and D.C. fields. Centrifugal starter. Splashproof covered. Frequency adjustable to load, plus or minus five cycles.

PRICE $97.50

Identical Machine, but 230 volts D. C. Input, $125.00

Set of Replacement Spart Parts for Either Machine $29.50

Prices f. o. b. Tuckahoe, New York
Immediate Delivery

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MOTOR GENERATOR SETS

New 1942-1944

1000 KW, 550 Volts DC, *ALLIS CHALMERS*, 720 RPM, motor synchronous, 2300 Volts, 3 phase, 60 cycle (6 units)
500 KW 600 Volts DC, WESTINGHOUSE, 900 RPM, Motor Synchronous, 2300 volts, 3 phase, 60 cycle, (7 units)
500 KW, 125/250 Volts D.C. Westinghouse, 720 RPM, motor synchronous, 3 phase, 60 cycle, 2300 Volts (3 units)
300 KW, 125/250 Volts DC, *WESTINGHOUSE*, 1200 RPM, Generators only. Will supply suitable motors (4 Units)
100 KW, *ELECTRIC PRODUCTS CO.* AC Generator, 3 phase, 60 cycle, 440 Volts 1200 RPM. Motor—*RELIANCE* 150 HP, 230 Volts DC, Complete switchgear (2 Units)

Immediately available.

A. G. SCHOONMAKER COMPANY, INC.
50 CHURCH STREET, NEW YORK
Established 1898 Digby 9-4350

NEW MOTORS... For Immediate Delivery

Single Phase, 60 Cycle, 115/230 Volts

QUA.	HP	MAKE	TYPE-FRAME	SPEED
10	⅙	General Electric	KH	1725
11	⅓	General Electric		1725
3	½	Holtzer Cabot		1750
195	½	Westinghouse	FJ-186	1725
3	¾	Holtzer Cabot		1725
1	1	General Electric	KC-203	1725
21	1½	General Electric	KC-204	1800
9	2	General Electric	KC-224	1800

3 Phase, 60 Cycle, 220/440 Volts

QUA.	HP	MAKE	TYPE-FRAME	SPEED
18	½	Westinghouse	FS-186	1140
9	¾	General Electric	K-203	1200
11	¾	Westinghouse	FS-186	1750
6	¾	U. S. Electric		1200
2	1	Westinghouse	CS-204	1750
1	1	Reuland	MC-203	1800
83	1	B-Line	PM-203	1800
1	1	General Electric	K-203	1800
33	1	Westinghouse	CSP-203	1750
1	1½	Sterling	Nema	1750
16	1½	General Electric	K-204	1800
6	1½	General Electric	K-204	1800
4	1½	General Electric	K-224	1200
13	2	General Electric	K-204	3600
7	2	Louis Allis	OGS-204	3520
6	2	U. S. Electric	204	3450
10	2	B-Line	RM-224	1800
42	2	General Electric	K-224	1750
1	2	General Electric	K-224	1750
2	2	General Electric	K-225	1200
3	2	General Electric	K-224	1800
3	2	General Electric	K-225	1200
1	2	General Electric	K-225	1200
7	2	General Electric	K-224	3600
29	3	General Electric	K-225	1800
85	3	General Electric	K-225	1750
4	3	B-Line	RM-225	1800
1	3	General Electric	K-225	1750
1	3	Hertner	CW-254	1150
8	3	General Electric	K-254	1200
2	3	General Electric	K-254	1200

QUA.	HP	MAKE	TYPE-FRAME	SPEED
2	3	Sterling	Nema	1200
2	5	B-Line	254R	1800
8	5	Hertner	Nema	1800
6	5	Sterling	254	1800
17	5	Westinghouse	CSP-234	1800
16	5	Westinghouse	CSP-254	1800
7	5	General Electric	K-254	1800
5	5	General Electric	K-284	1200
4	5	General Electric	K-284	1200
5	7½	Sterling	Nema	1800
9	7½	Westinghouse	CS-284	1700
2	7½	Westinghouse	CS-224	1700
14	7½	General Electric	K-284	1800
10	7½	General Electric	K-284	1800
4	7½	General Electric	K-324	1200
3	10	General Electric	K-324	1800
4	10	General Electric	K-324	1800
7	10	General Electric	K-326	1150
10	15	General Electric	K-326	1800
3	15	General Electric	K-326	1800
1	15	General Electric	KG-364	1200
4	15	General Electric	K-364	1200
5	15	General Electric	K-365	1200
8	20	General Electric	K-364	1800
1	20	General Electric	K-364	1800
1	20	U. S. Electric	364	1800
3	25	General Electric	K-364	1800
2	25	General Electric	K-365	1800
1	25	Westinghouse	CS-405	1170
3	30	General Electric	KF-405	1800
2	30	General Electric	KG-404	1800
1	30	General Electric	K-405	1200
2	30	General Electric	KF-444	1200
4	40	General Electric	K-404	1800
2	40	General Electric	KF-444	1800
1	50	Allis Chalmers	AR-445S	1750
1	50	General Electric	K-405	1800
1	75	General Electric	K-505	1200
1	100	General Electric	K-6323	1200
1	100	General Electric	K-6333	720
1	125	General Electric	K-6326S	1200

Hundreds Of Other Motors in Stock Up to 2000 HP— Both New And Rebuilt. Write, Wire or 'Phone

CHICAGO ELECTRIC COMPANY

1322 W. CERMAK RD. *Canal 2900* CHICAGO 8, ILL.

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

3 PHASE—25 CYCLE—220 440 VOLTS

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West.	CS		750
5	West.	CS	453	750
5	West.	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
15	G.E.	I Form K		750
15	West.	CS	573	750
20	West.	CS		730
25	West.	CS		730
40	G.E.	I Form K		750
75	G.E.	I Form K		500
100	G.E.	I Form K		750
100	West. (2200 v.)	CS	871/826	460
125	West (S.R.)	CW		480
150	G.E.	I Form K		365
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	Slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	1013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S.R.)	I Form M		480
200	West. (S.R.)	CW	1011	480

TRANSFORMERS

3—667 KVA New Transformers—O.I.S.C. 13,800 Volts Primary, 480 Volts Secondary, 1 Phase 60 Cycle with Taps —for June 1 delivery.

FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle. 100 cycle, 120 cycle, 180 and any other high cycle if desired.

HORIZONTAL & DUPLEX
Compressors & Vacuum Pumps after Coolers, Filters

25 CYCLE MOTORS

1—1370 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.
1—1900 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.

MOTOR GENERATOR SETS

2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP 3 Phase 25 Cycle motors.
1—30 KW Gen. Elec. Generator, Type DLC-203, 125 v. direct connected to 40 HP Gen. Elec. Motor, 3/440, 60/720 RPM with panel board.

ROTARY CONVERTER

1—2000 KW Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.

300 HP. COMPENSATOR

2—300 HP. Gen. Elect. Reduced Voltage manually operated Type CR1034, 3 Phase, 60 cycle, 440 volts. Floor Type with undervoltage and overload protection.

NEW MOTORS

300 New Gen. Elect. & Westinghouse Motors in stock from 1 to 100 H.P.

MOTORS

1—75 HP. Gen. Elect. Type I Form K., 3/60/440/720 RPM.
1—75 HP. Fynn-Weischel Synchronous 3/60/440/1200 RPM.
1—100 Gen. Elec. Slipring Type I Form M., 3/60/440/900 RPM.
1—100 HP. Gen. Elect. Type K (New Motor) 3/60/440/1800 RPM.
1—100 HP. Westinghouse Slipring Type CW, 3/60/440/435 RPM.
1—100 HP. Gen. Elect. Slipring Type I Form M, 3/60/440/2200/720 RPM.
1—100 HP. Westinghouse Motor Type CS-587A, 3/60/440/885 RPM.
1—100 HP. Westinghouse Slipring Type CW 3/60/440/1200 RPM.
1—100 HP. Gen. Elect. Slipring 3/60/440/1200 RPM.
1—200 HP. Gen. Elect. Slipring Type I Form M. 3/25/440/500 RPM.
1—500 HP. Allis Chalmers Slipring 3/60/2200/514 RPM.
1—500 HP. Gen. Elect. Type I Form K, 3/25/440/485 RPM.
1—600 HP. Westinghouse Motor Type CS, 3/25/550/490 RPM.
1—600 HP. Gen. Elect. Slipring Type MT, 3/25/550/490 RPM.
1—1500 HP. Allis Chalmers Synchronous, 3/60/2200/164 RPM.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

AVAILABLE

POWER PLANT EQUIPMENT

TURBO GENERATORS

1—3750 KVG G.E. 480 V. Cond.
1—2500 KVA West. 2300 V. Cond.
1—1250 KVA G.E. 480 V. Mix Pres.
1—187.5 KVA West. 240 V. Non Cond.

ENGINE GENERATORS

2—575 KVA Skinner Unaflow 220 V.
1—575 KVA Allis Chalmers Corliss 480 V.
2—187.5 KVA Ames Vertical 480 V.
1—156 KVA Ames Vertical 480 V.
1— 90 KVA Skinner 220 V.
1— 60 KVA Murray Corliss 220 V.

BOILERS

3—250 HP Heine 200# pressure
5—850 HP Sterling 250# 550° TT superheat

DIESEL ENGINES

2—100 KW Gen. Mtrs. 440 V.
2—400 KW F&M 2400 V.

WRITE-WIRE-PHONE
For Complete Specs.

BEESON ENGINEERING CO.
1628 E 7th St. Mu. 9151
Los Angeles, 21, Calif.

PUMPS-MOTORS

AIR COMPRESSORS
V-BELT DRIVES
ELECTRIC HOISTS
ALLIS-CHALMERS PUMPS
AURORA PUMPS
P & H HOISTS
M-G SETS
REBUILT MOTORS and PUMPS of all Sizes
In Our Stock

C & S MACHINERY CO.
715 Howard - St. Louis 6, Mo.
GArfield 4290

LARGE QUANTITY
NEW ILG MARINE BLOWER FANS
24"—6250 C.F.M. 33"—10000 C.F.M.
36"—15000 C.F.M.
Axial Flow—Propeller Type. Driven by 230 volt DC Motors.
ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th St. Philadelphia 22, Pa.

DIESEL GENERATOR UNIT
1500 H.P.—1250 KVA
Nelseco — General Electric
Modern, Supercharged, Bosch Injection
3/60/2400, 300 RPM, All Accessories, Complete
Immediate Stock Delivery Rebuilt
A. G. SCHOONMAKER COMPANY, INC.
50 Church St., New York 7, N. Y.
Phone Digby 9-4350

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

LARGE STOCK OF A.C. and D.C. MOTORS!

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
1	3	1750	440	West.	CW-232C
1	5	580	220	G.E.	HI-9
6	7½	810	550	G.E.	MTC-5201
1	7½	575	220	G.E.	MT-522
2	10	1140	440	West.	RF-7A
2	10	570	220	G.E.	HI-11
2	11‡	810	550	G.E.	ITC-5008
2	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	850	440	G.E.	MT-332
1	30	675	440	G.E.	MT-336
2	35	600	440	F-M	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	560	440	G.E.	MT-346
2	50	1150	440	G.E.	MT-536
1	50	869	440	West	HF-12A
5	52‡	550	220	G.E.	IQC-5013***
1	60	685	440	West	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW
1	75	720	550	G.E.	MT-556
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	150	900	440	G.E.	M-6334Z
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
3	250**	360	440	West.	CW-20-33-15
3	300	900	140	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
1	300	514	550	G.E.	IM-17A
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	700	720	2300/4000	West.	CW

All 220 volt motors can be reconnected for 440 volts and vice versa.
‡Intermittent rating. ***2 phase.
**New

230 VOLT CONSTANT SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1150	West.	SK-20
10	3	850	Reliance	T-23T
25	3½	850	West.	SK-30
3	7½	1750/1310	West.	SK-43
2	7½	1150	G.E.	CDM-66
2	7½	875/1750	West.	SK-631
3	7½	850	G.E.	CD-75
10 (new)	10	1750	Kimble	BA-324
5 (new)	10	1150	Al.-Ch.	EB-80
1	10	850	West.	SK-83
10 (new)	12½	600	West.	SK-93
5	15	825	West.	SK-90
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-1101
17	25	825	West.	SK-120
1	30	750	G.E.	RC
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	650	G.E.	RC-16
2	60	1750/1310	West.	SK-143
3	75	850	West.	SK-160
1	150	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	1½/2	500/200	G.E.	CD-65
1	2	225/900	Reliance	78T
2	6	450/1800	G.E.	RF-9
6	5/7½	600/1800	G.E.	RA-30
1	12½	280/840	West.	SK-130
10 (new)	12½	600	West.	SK-93
1	15/20	500/1500	G.E.	CD-95
1	20/25	300/1200	West.	SK-153
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	35	500/1500	West.	SK-143
2	40/50	400/1600	Al.-Ch.	EB-147
1	75	500/1500	Cr.-Wh.	CCM
1	75	375/750	Cr.-Ch.	CMC-125H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	175	230/750	West.	SK-220
2	375	350/500	G.E.	MPC

VARIABLE VOLTAGE DRIVES
40 HP. Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW. 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP. 400/1500 RPM, Frame 385T, 230 Volt. DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

125 HP, 30/25 Cycle Motors
2—West. Type CS, Frame 871.52C 125 HP. Cont 50°, 1750 RPM. 30 cycle, 1500 RPM. 25 cycle, 440 Volt, 3 phase, Squirrel Cage Motors.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Totally Enclosed Fan Cooled, Ball Bearing

Qn.	H.P.	RPM	Volts	Make	Type & Frame
2	¼	1750	220	R&M(TE)	L-184
1	¼	1725	440	G.E.	K-63
1	½	1625	220	F-M(TE)	QOZE-FW203
4	1	1140	220	Howell	A-204
4	1.5	1150	220	L.A.(TE)	IS-225
5	1.5	1140	440	West.	CS-225
1	2	1735	220	G.E.	K-224
4	2	1140	220	L.A.	JS-225Y
1	2	1100	440	West.	CS-225
1	3	3450	220	Howell	K-224
4	3	1160	440	L.A.	JS-254
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
14	5	1730	440	G.E.	K-254
1	5	1720	440	Century	SCH-254
2	5	1165	440	L.A.	JA-284
5	7.5	1740	440	G.E.	K-284
1	7.5	1735	220	G.E.	KF-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1**	10	880	220	West.	CS-365-EXPF
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	25	1760	550	G.E.	K-405
4	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504
1	75	875	440	L.A.	JX-608OS

Splashproof Ball Bearing

1	2	1735	440	G.E.	K-224
1	3	1160	440	L.A.	FS-254
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1150	440	L.A.	FX-365
3	30	3520	440	L.A.	FX-365S
1	40	1760	440	L.A.	FX-444
3	40	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
2	75	870	440	West.	CS-752-C
1	125	1770	440	L.A.	FX-1078Y
1	150	1775	440	L.A.	FX-1168
5	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	K-6335
1	200	885	440	L.A.	FS-1378

Open Type Motors

Qn.	H.P.	Speed	Volts	Make	Type
5	2	1740	440	G.E.	KT-926
4	2	1160	440	West.	CS-93C
1	2	690	440	G.E.	KT-944
10	5	1740	440	West.	CS-232C
1	7½	3475	440	West.	CS
1	7½	1750	440	West.	CS-250C
3	7½	1165	440	G.E.	KT-952
2	7½	870	440	West.	CS-370C
3	10	1160	440	West.	CS-370C
1	10	865	440	G.E.	KT-502
1	15	3485	220	Reliance	AA-B3247
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E.	KT-312
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRB-358***
2	25	575	440	G.E.	KT-542
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
3	40	1750	440	West.	CS-583C
3	40	1175	220	G.E.	K-445
2	40	900	2300	G.E.	FTR-536
5	50	1160	220	G.E.	K-504
1	50	850	220	West.	CCL
2	60	900	440	G.E.	KT-346
1	75	1160	440	West.	CS-662-C
1	100	1765	2200	West.	CS-765A
1	100	690	220	West.	C
1	100	580	2200	G.E.	IK-15A
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.-Ch.	AN
2	125	435	440	Al.-Ch.	AR
2	125	400	2300	G.E.	I-17-FR
1	150	1780	440	G.E.	K-547
1	150	1200	2300	G.E.	KTP-557
2	200	1750	440	West.	CS-855S
2	200	580	550‡‡	G.E.	KT-566S
2	350	1750	2300	G.E.	K-559BS
1	500	1200	440	G.E.	KTP-567
1	700	1800	2300/4000	West.	CS-4-39D-12

All 220 Volt Motors can be Reconnected for 440 Volts and Vice Versa.
**New. ***2 Phase.
‡‡Reconnectable for 440 volts.

CRANE, MILL TYPE 230 V. D.C. MOTORS

Qn.	H.P.	Speed	Make	Type
2 (115 v.)	3½	700	G.E.	CO-1803
2	5½	760	West.	MCB-20
1 (new)	10	650	G.E.	MD-403-BE
1	20	515	West.	K-6
3	25	590	Diehl	TE
2	35	750	G.E.	CO-1828
3 (new)	35	600	West.	CK-9
1	50	750	G.E.	CO-1829A
1	50	600	West.	CK-9
5 (new)	50	525	G.E.	COM-1830AE
1	59	470	G.E.	CO-2007
2 (new)	60	550	G.E.	COM-1831AE
4	65	450	G.E.	COM-1830

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment Is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVE. CLEVELAND 14, OHIO

POWER EQUIPMENT

NORTHERN METAL COMPANY — TOPS IN DEPENDABILITY

DIESEL ENGINES — DIESEL GENERATORS
TURBO GENERATORS

WE HAVE ON HAND ONE OF THE LARGEST INVENTORIES OF POWER EQUIPMENT IN THE EAST . . . . . .

MOTOR GENERATORS - STEAM ENG. GENERATORS - CENTRIFUGAL FANS - CENTRIFUGAL PUMPS
ROTARY PUMPS - RECIPROCATING PUMPS - MACHINE TOOLS - MOTORS A-C D-C - AIR COMPRESSORS

WRITE OR PHONE FOR INFORMATION

NORTHERN METAL COMPANY

MILNOR & BLIGH STS. . . . SHIPWRECKERS . . . PHILADELPHIA 35, PA.
PHONE MA 4-1400

WORLD'S LARGEST INVENTORY

PARTIAL STOCK LIST AS OF MAY 1, 1948

TRANSFORMERS 60 Cycle—OIL TYPE

QUAN.	KVA.	PRI. V.	SEC. V.	QUAN.	KVA.	PRI. V.	SEC. V.
2	2000	24000	3200	3	200	4150	480
	1500	2200	600	3	200	4000	240/480
6	1250	66000	22000/11000		200	4000	115/230
	1000	2200	220	3	200	2400	220/440
3	667	2300	600	3	200	2400	120/240
	600	440	220	6	200	2300	230/460
	540	680	82	3	200	575	115/230
3	500	7590	440/220		180	6400	1200
9	500	2400	240/480	3	167	2400	240/480
	500	4160	480	3	150	2400	220/440
3	333	13800	110/220	17	150	2400	120/240
3	333	11000	2300	3	150	2300	550
3	300	2400	120/240		138	2300	1626
3	300	2300	115/230	2	125	440	440
	260	480	110/220		125	440	110/220
32	250	2400	240/480	3	100	33000	2400
3	250	2300	178	2	100	11000	2300
	250	463	178	3	100	7200	2400
3	200	13200	240/480	3	100	7200	120/240
5	200	7200	120/240		100/ 3 ph.	4150	120/208
2	200	4600	115/230	12	100	2400	240/480

Smaller Units in STOCK — Ask for Listings
Primary are Delta Connected, multiply by 1.73 for Y connection.
872 Smaller Ratings — Also Large Stock — 25 Cycle and new Air-Cooled Transformers

MOTOR GENERATOR SETS

KW	DC	AC DRIVE	KW	DC	AC DRIVE
1000	550	6600/11400/60/3 Syn.	(2) 200	250	2300/60/3 Syn.
(3) 500	750/1500	2300/60/3 Syn.	200	250	6600/25/3 Sq. Cg.
(3) 500	550	2300/60/3 Syn.	200	125	2200/60/3 Sq. Cg.
500	250	2300/60/3 Syn.	170	125	2200/60/3 Sq. Cg.
400	125/250	2300/60/3 Syn.	150	250	440/60/3 Syn.
400	250	4150/60/3 Syn.	(3) 125	250	Any Specs.
300	750	2300/60/3 Sq. Cg.	100	250	220/440/60/3 Syn.
(6) 300	125/250	Any Specs.	100	125	220/60/3 Syn.
250	550/550	2300/60/3 Sq. Cg.			

Any Smaller Size in Stock—Can Assemble Motor Generator Sets to your exact specs.

Ask for Listings

Electric Equipment Co., Rochester 1, N. Y.
Send Us Your Inquiries For
Motors, Generators, Motor Generator Sets
Immediate Shipment from Our Large Stock—All Ratings
$ $ Cash for your Surplus Transformers $ $

SYNCH. CONVERTERS

300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM, 6 PH. 60 CY. TRANSFORMERS.

300 KW WEST 600 D.C. 13200/6600. 4000/2200 A.C. 1200 RPM, 3 PH. 60 CY. TRANSFORMERS.

MOTOR GENERATORS

500 KW G.E. SYN. 600 V. 2300/4000 A.C. 900 RPM, 3 PH. 6 CY.

400 KW WEST. SYN. 600 V. 2300/4000 A.C. 720 RPM, 3 PH. 60 CY.

300 KW G.E. SYN. 125/250 V. 2300/4000 A.C. 1200 RPM, 3 PH. 60 CY.

250 KW G.E. SYN. 125/250 V. 2300/4000 A.C. 720 RPM, 3 PH. 60 CY.

150 KW WEST SYN. 250 V. 2300 A.C. 900 RPM, 3 PH. 60 CY.

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK COMPANY
502 Grant Building, Pittsburgh, Pa.

POWER EQUIPMENT—READY TO SHIP

SAVE OVER 50% ON NEW INDUSTRIAL BLOWERS AND VENTILATING FANS

AXIAL FLOW VENTILATING FANS

5—50" dia. 72½" long, 2 sets of propellers, 8 blades to each. Dim; of blade 14"x9½" curved mfg'd by International. Size 114, driven by 100 HP., 1750 rpm., 220/440 v. 3 ph. 60 cy. A.C. Motor.
6—16000 CFM Buffalo Forge Co., 3" stat. pres. 1800/1200 rpm con. 15/4.5 HP., 1710/1150 rpm 3 ph. 60 cy. G.E. A.C. Motor 220/440 v. totally encl.
2—12000 CFM 3" stat. pres. Sturtevant with dir. con. 10/3 HP 1775/1180 rpm., 220/440 v. West. CS. TEFC Motor.
1—7500 cfm Clarage with dir. con. 7½ hp., 1750 rpm., 3.3 hp at 1160 rpm., 220/440 v. 3 ph. 60 cy.
2—6000 cfm. Sturtevant 1.65" stat. pres. dir. con. 2.7/.8 hp 220/3/60 A.C. Motor.
31—6000 cfm Sturtevant Bulletin 512389, 3" stat. pres. 7 blade, dir. con. 5/1.5 HP., 1765/1175 rpm., 220/440 v. 3 ph. 60 cy. West. TEFC Motors.
2—5000 cfm Sturtevant 1.8 stat. pres. 4.2/1.25 HP., 1750/1150 rpm 3 ph. 60 cy., 220/440 v. ball bearing motors.
2—4000 cfm 3" stat. pres. Sturtevant dir. con. 2 speed, TE Westinghouse 220/440 v. Motors.
1—4000 cfm 3" stat. pres. Sturtevant Axial Flow vent fan dir. con. 4/1.2 HP., 1750/1150 rpm., 220/440 v., 3 ph. 60 cy. Tot. Enc. West Motor.

115 Volt. D C

8—4000 CFM Sturtevant 3" stat. pres. 115 V. Westinghouse SK Motors.
4—4000 cfm American Blower 3" stat. pres. 4/1.7 HP., 1750/1310 rpm 115 v. Westinghouse SK Motors.
1—3000 cfm 3" stat. pres. B. F. Sturtevant 1750 rpm., dir. con. 3/1.25 HP., 115 v. D.C. Motor
1—250 CFM—2½" stat. L. J. Wing, with dir. con. 1/5 HP., 3300 rpm Diehl Motor.

NEW—CENTRIFUGAL BLOWERS

1—7500 CFM "Sirocco" 2.2 stat. pres. 1160 rpm., size 275-85 mfg by American Blower dir. con. 7½ hp., 1160 rpm., 220/440 v. 3 ph. 60 cy. Wagner TEFC Motor.
1—6100 CFM "SIROCCO" 2.2 stat. pres. mfg'd by American Blower dir. con. 220/440 v. 3 ph. 60 cy. A.C. Motor.
1—5700 CFM Sirocco 2.2 stat. pres. size 244, mfg by American Blower dir. con. 2 speed 220 or 440 v. TEFC ball bearing motor.
1—Roots Connersville Industrial Blower 16x30 with 8 to 1 ratio gear reduction unit, dual shaft unit with single pulley shaft complete with 150 HP. 220 or 440 v. 3 ph. 60 cy. A.C. Motor.

MOTOR GENERATOR SETS

250 V. D. C.

(Motors 220/440 or 2200 v. 3 ph. 60 cy.)

No.	KW	Make	Speed
1	175	West.	1200
1	150	Star	1200
1	135	G.E.	1150
1	110	West.	710
1	100	G.E.	1150
1 new	100	G.E.	1200
1	75	West.	1200
1	50	West.	1200
3	40	West.	860
1	35	G.E.	850
1	30	G.E.	720
1	30	West.	850
1	30	West.	1150
1	25	West.	1150
1	20	G.E.	1150
1	15	West.	1750
1	10	West.	1750

VARIABLE SPEED MOTORS

230 V. D. C.

No.	HP	Make	Type	RPM
3	133	G.E.	CDM	875/1750
4	50	West.	SK-190	320/960
4	50	West.	SK	300/1200
1	45	West.	SK-143	500/1500
1	40	West.	SK-180	385/1200
1	40	Al. Chal.		400/1200
1	35	West.	SK-143	500/1500
1	30	G.E.	DLC-50	400/1200
1	20	West.	SK-123	400/1600
1	20	West.	SK-110	500/1500
1	15	West.	SK-100	500/1500
2	10	G.E.	RF	400/1200

TRANSFORMERS

1 ph. 60 cy.

No.	KVA	Make	Pri.	Sec.
2 new	15	Allis Chal.	440	220
25 new	25	Allis Chal.	450	120
20 new	25	Allis Chal.	440	110/220
15 new	25	Allis Chal.	220	220/110
3 new	37½	West.	450	120
1	50	G.E.	2300	220/440

SLIP RING MOTORS

3 ph. 60 cy.

No.	HP	Type	Volts	Make	RPM
2	700	MT-415	2200	G.E.	900
2	600	MT	2200	G.E.	900
2	400	MT	2200	G.E.	900
2 new	200		220/440	G.E.	600
1	75	I-M	220/440	G.E.	600
10	50	CW	2200/220/440	West.	860

DYNAMOMETER

"Hi-Eff" hydraulic size 35#, model 588, 3100 rpm., Taylor Mfg. Co.

FREQUENCY CHANGERS

3—25 kw., 220/440 v. 3 ph. 180 cy., G.E. dir. con. to 25 HP, 1800 rpm., 220/440 v. 3 ph. 60 cy. motors.

AIR COMPRESSORS

10—240 cfm Westinghouse, type 3 VS-23, 3 cyl. vert. 150# psi, dir. con. 50 HP., 220/440 or 2200 v., 3 ph. 60 cy., West. Slip Ring Motors. Equipped with automatic control. (Can furnish D.C. Mtr. if desired or Oil or Gasoline Engines)

SYNCHRONOUS MOTORS

1—New 500 HP., Elec. Machy. Co. 2200/220 or 440 v. 120 rpm.

POWER PLANTS

5—NEW 1½ kw. Homelite portable 115 v. 1 ph. 60 cy. 1 cyl. air cooled 2 cycle gas or gasoline.
2—10 kw. 120/v. Star Generators dir. con. to Hercules DIESEL, 250.
2—30 kw. 125/v. G.E. Gen. dir. con. Buda DIESEL.
1—35 kva. Ridgway 220/3/60 dir. con. Ridgway STEAM engine.
1—125 kva. West 240/480 v. ph. 60 cy. West. dir. con. Erie Ball STEAM Engine.

INDUCTION HEATING CONVERTER

New Van Norman, type indoor, floor, hi-freq. 32 kw. 220 v. 1 ph., 60 cy. 150 A. enclosed type.

PUMPS

3—1000 GPM Worthington Cent. 1 stage, 6½" suc. 5" dis. 150# pres. dir. con. 133 HP., 875/1750 rpm., 230 v. DC Motors and control. (Can furnish A.C. Motors if desired.)

WINCHES

240—Winch assembly portable engine hoists, swivel hook, 4¾" l, with 1½" opening and 30' of ¼" cable. Hand cranked, double reduction gear with drum 5¾" w. can be used with A.C. or D.C. Motors.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

BOILERS

2—404 H.P. Springfield, oil burners 170#
1—550 H.P. W.W. sectional header 200#
4—300 H.P. Casey-Hedges, oil, 165#
2—25,000# Stirling's, pulverizers, 425#
4—160 H.P. 160# HRT (suspended) NATIONAL BOARD, oil & spreader stokers (complete plant)

H. P. BREARLEY
3423-91st Street Jackson Heights, N. Y.

ELECTRICAL & POWER PLANT EQUIPMENT

3—8000 KVA 3 phase Transformers 11000-160/100
10—2000 KVA 3 phase Transformers 11500-460
3— 333 KVA 1 phase Transformers 4160/2400-190/125
1— 150 KVA 3 phase Transformers 480-120
1— 150 KVA 1 phase Transformers 480-120
1— 100 KVA 1 phase Transformers 576/480-115
1— 45 KVA 1 phase Transformers 240-90/180
2— 40 KVA 1 phase Transformers 440-220
2—37½ KVA 1 phase Transformers 480-120
16—1 to 25 KVA 1 phase Transformers 460/230-230/115
12,000 Ft.—#4 to 750,000 CM, Lead covered single conductor Cable
2—50 HP D.C. Motors, 230 V., 1100 & 1150 RPM
1—50 HP D.C. Motors, 220 V., 750/955 RPM
28—7½ to 30 HP A.C. Motors, 3/60/440—660 to 3500 RPM
90—½ to 7½ HP Gear Motors D.C. & A.C.-3.5 to 505 RPM
2—1500 GPM Water Cooling Towers
3—910,000 BTU per hr. Oil Coolers
2—2,450,000 BTU per hr. Oil Coolers
2—125 HP — 250# Locomotive type Boiler, Superheater
360—G.E. Clamp on Heating Units, 2250 Watts, 115 V.
15—KV Switchgear cubicles, 10 at 1200 amps, 3 at 2000 amps.
2300 V Cubicles, 4 at 600 amps, 1—1200 amps.
4—250 HP Roots 7000 Ft. Blowers
100,000 Ft. Cap. Gas Holder

R. C. STANHOPE, INC.
60 E. 42nd St., New York 17, N. Y.

TURBO GENERATORS

TURBINE OF THE MONTH

1—750 KW Gen. Elec. 275 lbs. I.S.P. Surface Condenser, Auxiliaries, 3 Phase, 60 Cycle, 440 Volts, Direct Connected Exciter. Equipment Built 1943.

1—3000 KW Whse. 3750 KVA, 2300v, 3 ph., 60 cy. with Parsons 200 lb. cond. turbine
1—2000 KW G.E. 6600v, 3 ph., 60 cy. with 175 lb. cond. turbine and dir. conn. exciter
1—1500 KW G.E. 2300v, 3 ph., 60 cy. with G.E. 225 lbs. cond. turbine, surface condenser
1—1500 KW Whse. 480v, 3 ph., 60 cy. with 160/175 lbs. Surface Condenser, panel & exciter
2—1250 KW G.E. 2300v, 3 ph., 60 cy. with 175 lbs. condensing turbine
1—1250 KW Al Ch. 2300v, 3 ph., 60 cy. with 200 lb. condensing turbine, surface condenser
1—1000 KW G.E. 2300/4150v, 3 ph., 60 cy. with 135/150 lb. condensing turbine
1—500 KW G.E. 480v, 3 ph., 60 cy. dir. conn. exciter with 80/100 lbs. I.S.P., 10/15 lbs. B.P., non-condensing turbine

BELYEA COMPANY INC.

43 HOWELL ST. JERSEY CITY 6, N. J.
Phone—Journal Square 2-3334
ALSO N. Y. CITY LINE—RECTOR 2-7150

Most all units still on foundation. Many may be seen operating

DIESEL UNITS

375 KVA Fairbanks Morse, 480 v.—Model 22E-14
200 KVA Fairbanks Morse Model 32 Style VA
187 KVA Fairbanks M. 2400/440/220 v.—Marine Type
169 KVA GE 440/220 v.—Worthington
156 KVA Ideal 240/480 v.—Buckeye
93.8 KVA Electric Machinery—Superior
75 KVA General Motors 440/220 v.
62 KVA GE 220/120 v.—Gen. Motors
50 KVA Fairbanks M. 240 v.—Model 36A

TURBO UNITS (NON-COND.)

125 KVA GE 440/220 v.
155 KVA (2) Al Chal 220/440 v.
187 KVA General Electric 440/220 v.
250 KVA General Electric 600 v.
250 KVA General Electric 440/220 v.
375 KVA (2) General Electric 2300 v.
375 KVA GE-Terry 220/440 v.
625 KVA General Electric 2300 v.
937 KVA General Electric 2300 v.

TURBO UNITS (COND.)

250 KVA GE 480 v. (250/400#)
750 KVA GE; 2300 v. 250#
750 KVA General Electric 240/480 v.
937 KVA General Electric 2300 v.
1250 KVA General Electric, 2300 v.
1250 KVA Westinghouse 2300 v.
1250 KVA General Electric 600 v.
1250 KVA (2) Allis Chalmers 4000/2300 v.
1875 KVA (2) General Electric 2300 v.
2500 KVA General Electric 600 v.

BOILERS

250 HP Erie City 180#
406 HP (2) Heine 180#
418 HP Combustion 400#, water walls
469 HP (2) Sterling 425#
507 HP Combustion 4 drum 400#
508 HP Combustion 4 drum 200#
700 HP Sterling, 250#
1038 HP Springfield 225#

STEAM ENGINE SETS, A. C.

79 KVA Allis Chalmers 480/240 v.—Ames Unif.
187 KVA General Electric 240/480 v.—Chuse 4 v.
187 KVA Westinghouse 240/480 v.—Ames Unif. Ver.
375 KVA General Electric 2300/440 v. Chuse 4 v.
450 KVA General Electric 2300/440 v.—Ames Unif.
500 KVA Crocker Wheeler 240/480 v.—Nordberg Unif.
625 KVA General Electric, 2300/440 v. Skinner Unif.
688 KVA Allis Chalmers 600 v.—Al. Chal. Corliss

DIESEL UNIT

375 KVA Fairbanks Morse 480 v.—Model 32E-14

GAS ENGINE UNIT

375 KVA GE 3/60/480 v.—Cooper Bessemer

SURFACE CONDENSER

3500 sq. ft. Wheeler surface condenser

POWER PLANT EQUIPMENT CO., INC. 39 Cortlandt St. New York, N. Y.

TURBO GENERATORS

375 KVA., 3 phase, 60 cycle, 450 volt Gen. Elec. 400 lbs. steam.
500 KW., 3 phase, 60 cycle, 440 volt Gen. Elec. #39937 with surface condenser, evactor, and switchboard.
750 KW. Gen. Elec., 150 lbs. steam, 10-20 lbs. extraction.
1000 KW., Gen. Elec., 190 lbs. steam up to 50 lbs. B.P. non condensing.

MOTOR GENERATORS

300 KW., 250 volt Gen. Elec. to a 435 HP., 3 phase synch. motor with boards.
100 KW., 125 volt Gen. Elec. to a 150 HP., 3 phase motor.
80 KW., 80 volt Burke with synch. motor and panels.
50 KW., 250 volt Westgh. to 3 phase synch. motor.

TRANSFORMERS

1—750 KW. Westgh. 13800 x 80 down to 60 volts.
2—150 KVA. Pittsburgh 2300 x 230/460 volt.
2—150 KVA. Pitsburgh 2400 x 120-240 volt.
4—100 KVA. Westgh. 13200 x 2200 volt.
3—100 KVA. Westgh. 13800 x 230/460 volt.
Over 100 NEW Gen. Elec. up to 75 KVA., 450 x 120 volt.

DC ENGINE GENERATOR

150 KW., 125 volt Crocker Wheeler to a 4 cylinder vertical Ames engine.

MOTORS

Large stock AC & DC motors
All above equipment actually in stock. Send for our list of many other items we have.

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Power Plant Equipment Company
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ELECTRICAL CABLE
BOUGHT AND SOLD
★ For every industrial and power application
★ LARGE STOCKS ON HAND
★ RAPID DELIVERY
★ CUT TO LENGTH
★ Send us your inquiries
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You √ your
COMPRESSORS VACUUM PUMPS
New & Guaranteed Rebuilts
Stationary & Portable
SALES OR RENTAL
Trade in your present unit
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Authorized Distributors
AMERICAN AIR COMPRESSOR CORP.
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WURTH for "WORTH"!
A. C. GENERATORS 3 PHASE—1 PHASE 15 to 62½ KVA
LARGEST STOCK OF A.C. AND D.C. MOTORS FROM 5 TO 200 H.P.
D.C. MOTOR GENERATOR SETS TO 75 KW • HIGH CYCLE GENERATORS
Send for Our Latest Stock List
WURTH ELECTRIC MOTOR COMPANY
Motors, Generators, Alternators, Frequency Changers.
141 GRAND ST. — CAnal 6-6138 — NEW YORK CITY

FOR SALE
FUEL OIL HEATERS
4—Whitlock Type R, extra heavy with valves and fittings. 300 sq. ft. 300 PSI shell test. 375 PSI oil side test. ¾" #16 BWG steel tubes. Thoroughly reconditioned.
TAMPA ARMATURE WORKS, INC.
P. O. BOX 1318 TAMPA, FLA.

3460 FT. CAP. CHICAGO PNEUMATIC CLASS OCTDE
625 HP, 3 P. 60 C. 2300 V. SYN. DRIVE AIR COMPRESSOR
R. C. STANHOPE, INC., 60 E. 42nd St., N. Y. 17, N. Y.

FOR SALE
3-74,000 BBL. CAP. STEEL STORAGE TANKS
DARIEN CORP.
60 E. 42nd St., New York 17, N. Y.

SLIP RING MOTORS
3-PH., 60 Cy.

HP	Volts	Make	Speed
200	2200/440	G.E.	600
200	440/220	G.E.	720
200	2200/440	G.E.	1200
150	2200/440	G.E.	1200
125	440/220	G.E.	600
150	440/220	Whse.	1200
125	440/220	G.E. (Hoist)	900
100	440/220	G.E.	720
100	440/220	G.E. (MTC)	900
100	2200/440	G.E.	600
80	440/220	G.E. (MTC)	900
75	2200/550	G.E.	900
60	440/220	G.E.	1200
60	440/220	Cr. Wh.	720
50	440/220	G.E.	900
40	440/220	G.E.	720

SYNCHRONOUS MOTORS
3-PH., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	ATI	600
250	440/220	Whse.	HR	277
240	2200/550	G.E.	ATI	900
240	440/220	G.E.	ATI	720
200	4150/2300	Whse.	G	1800
200	2200	G.E.	ATI	514
150	4150/2300	G	G	1800
150	440/220	G.E.	ATI	900
150	2200/440	G.E.	TS	600
125	2300	G.E.	TS	327
110	440/220	G.E.	TS	1800
110	440/220	G.E.	TS	257
100	440/220	G.E.	TS	900
100	440/220/25 cy	G.E.	TS	375
100	440/220	Whse.	G	1800
75	2200/440	Whse.	G	600
75	440/220	G.E.	TS	900

AIR COMPRESSOR UNIT
1—13″ and 8″ by 10″ Worthington FEATHER-VALVE, 285 rpm, 110 lbs. ga., motor-driven, complete

CIRCUIT BREAKERS
1—5000 amp., ITE, 3 pole, 600 v., air
1—4000 amp., ITE, 3 pole, 600 v., air
2—2000 amp., G E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
600	2300/440	G.E.	KT	1200
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
350	2200/440	Whse.	CS	600
300	2200/440	Whse.	CS	600
300	440/220	G.E.	KT	1800
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	600
200	440	Whse.	CS	900
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
125 vert.	440/220	G.E.	KTP	1200
125	440	G.E.	KT	600
100	440/220	G.E.	KT	450
100	440/550	G.E.	KT	400
100	440	Whse.	CS	1800
75	440	G.E.	KT	360
75	550/220	G.E.	KT	1200
75	440	G.E.	KT	400

TUBO-GENERATOR
Generator, 125 kva. 1200 rpm. 440/220 v., Whse., dir. conn. by reduction gear to Turbine, 100 kw. 7380 rpm. non-condensing, 150/200 lbs. ga. pr., complete with dir. conn. exciter and switchboard; practically new condition, never used.

A. C. GENERATORS
1—320 kva., 600 rpm., 440/220 v., G.E.
1—300 kva., 600 rpm., 2200/440 v., G.E.
1—225 kva., 900 rpm., 2200/550 v., G.E.
1—225 kva., 720 rpm., 440/220 v., G.E.
1—190 kva., 514 rpm., 220/440 v., G.E.
1—150 kva., 900 rpm., 440/220 v., G.E.
1—100 kva., 327 rpm., 2300 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.
2— 75 kva., 1200 rpm., 440/220 v., G.E.
2— 30 kw., 1200 rpm., 440/220 v., G.E.

MOTOR GENERATOR SETS
1—125 kw., 250 v., 1200 R. Cr. Wh. conn. to 200 hp. 2200/440 v., 3 ph., Sq. C. motor.
1—100 kw., 125 v., 1200 rpm. Whse., conn. to 150 hp. 440/220 v., 3 ph. syn. motor.
1—75 kw., 250 v., 1200 rpm. Whse., conn. to 112 hp. 440/220 v., sq. cage motor.
1—50 kw., 250 v., 1200 rpm., G.E., conn. to 75 hp. 440/220 v., 60 cy., G.E. syn. motor
1—50 kw., 125 v., 1200 rpm. Whse., conn. to 75 hp. 440/220 v., 60 cy., syn. motor.
1—25 kw., 440/220 v., 1800 rpm. G.E. alternator conn. to 40 hp. 230 v., DC motor.

TRANSFORMERS
60 Cycle
1—1000 kva. Al. Chal., 2400-120/240/208 volts, 3 phase. NEW.
1—400 kva. G.E. 2300-230/115 v.
3—200 kva. Al. Chal., 2400-120/240 volts. NEW.
1—150 kva. Whse. SK. 13200-125/215 v. 3 ph.
6—100 kva. G.E. 4600/2300-230/115. NEW.
3—50 kva. Whse. 4600/2300-230/115.
6—37½ kva. Whse. 440-115. DRY.
8—25 Kva. G.E. 7200-120/240. NEW.
3—25 kva. G.E. 2300-230/115. DRY.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

NEW
ALL BRONZE PUMPS

1—150 G.P.M.—60 ft. Head Fairbanks Morse Centrifugal, 1½″ S. & D., Req. 5 H.P. 1800 RPM Motor.
8—30-85 G.P.M.—87-30 ft. Head Worthington Monobloc, 1½″ S. & D., 2 H.P. 3 ph., 3600 RPM, T.E. F.C. Motors.
2—30-45 G.P.M.—80-30 ft. Head Westco Turbine, 1½″ S. & D., ¾ to 1½ H.P. 1800 RPM Motors Req.
2—10 H.P.M.—25 lbs. Press. Fairbanks Morse, Bronze Sanitary Type Rotary, 1″ S. & D.

DELTA EQUIPMENT CO.
148 N. 3d St., Phila. 6, Pa.

4000
High Cycle Drills
¼″ Capacity 220 Volts
180 Cycles .65 Amps

D. C. ELPHINSTONE, INC.
115 S. Calvert St.
BALTIMORE 2, MD.

TRANSFORMERS
1 KVA up to 200 KVA in stock

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Phila 34, Pa.
Phone Ga. 5-0488

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100 H.P. AMES ECONOMIC
ASME 125 LB. PRES. BOILER
60 FT. STACK & GRATES

DARIEN CORP., 60 E. 42nd St., N. Y., N. Y.

WHAT DO YOU NEED? We Probably Have It!
Partial List from Current Stock

Reconditioned & Guaranteed
SLIP RING MOTORS
440 volts, 3 phase, 60 cycle

Qu.	HP	RPM	Make	Type
1	20	1800	G.E.	
2	50	900	L. Allis	BB, DP w/control
2	75	900	L. Allis	BB, DP
1	150	900	Wagner	SB, Type BR

Reconditioned & Guaranteed
CONSTANT SPEED D. C. MOTORS,
230 volts

17	3	850	Rel.	BB, Shunt
4	5	320	G.E.	SB
2	5	690	G.E.	SB, RC31
12	7½	600	Wstg.	BB, TE, Comp.
1	7½	600	E-D	BB, Shunt
1	7½	850	Wstg.	SB, Comp.
1	10	850	Sprague	SB, Comp.
1	15	550	G.E.	Interpole, Compl.
1	15	1150/1750	Rel.	BB, Shunt
1	25	1150	Wstg.	SB, Fr. 103
1	35	675	Wstg.	SB, Shunt
1	40	850	G.E.	SB, CD113
1	50	500	G.E.	SB, Shunt
2	50	525	G.E.	BB, TENV (New)
1	50	565	Wstg.	SB-SK
1	75	1330/1760	Rel.	BB, DP, Shunt
1	110	290	Triumph	Interople

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4	15/20	400/1200	G.E.	RLC-203A, Shunt
1	15/20	600/1800	Rel.	131-T
1	20/25	400/1200	E.D.	
7	20/25	600/2000	G.E.	CD-105
1	25/30	500/1500	Rel.	Shunt
1	30/40	400/1200	G.E.	RLC-204
3	40	250/1500	G.E.	CD-1441
1	40/50	350/1050	Wstg.	SK
1	50/60	300/900	E.D.	Frame 30-S
1	150	262/750	G.E.	MPC, Shunt

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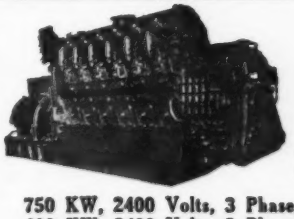

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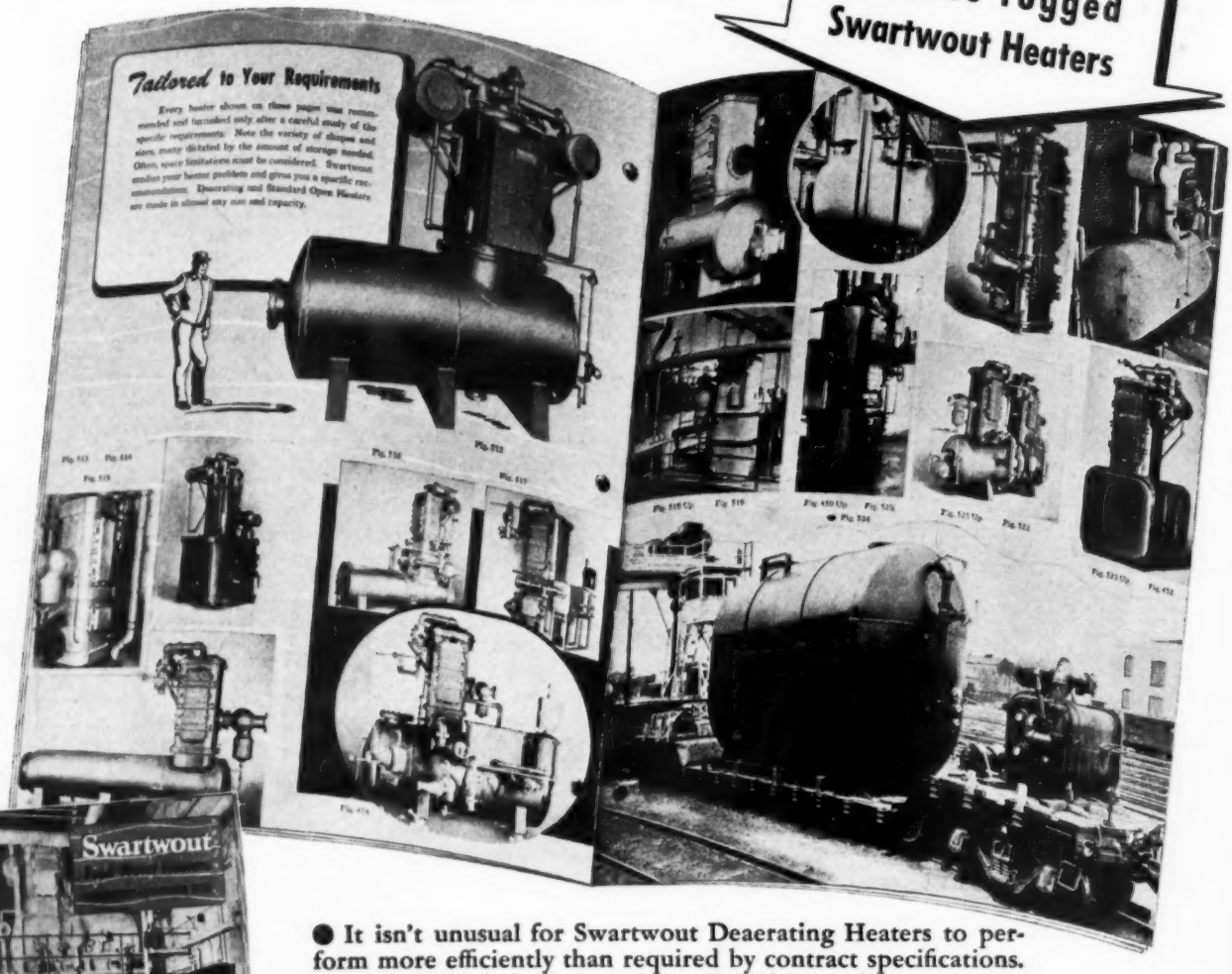
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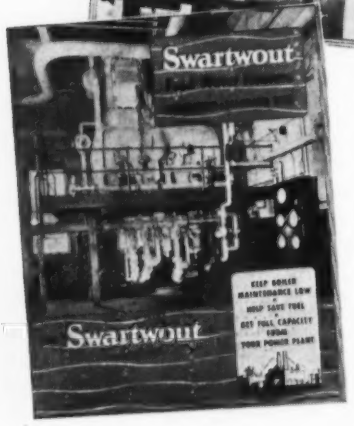

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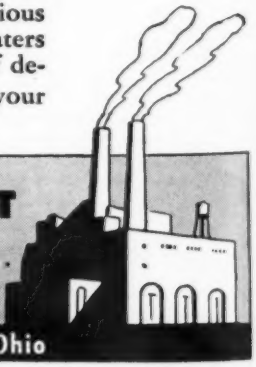

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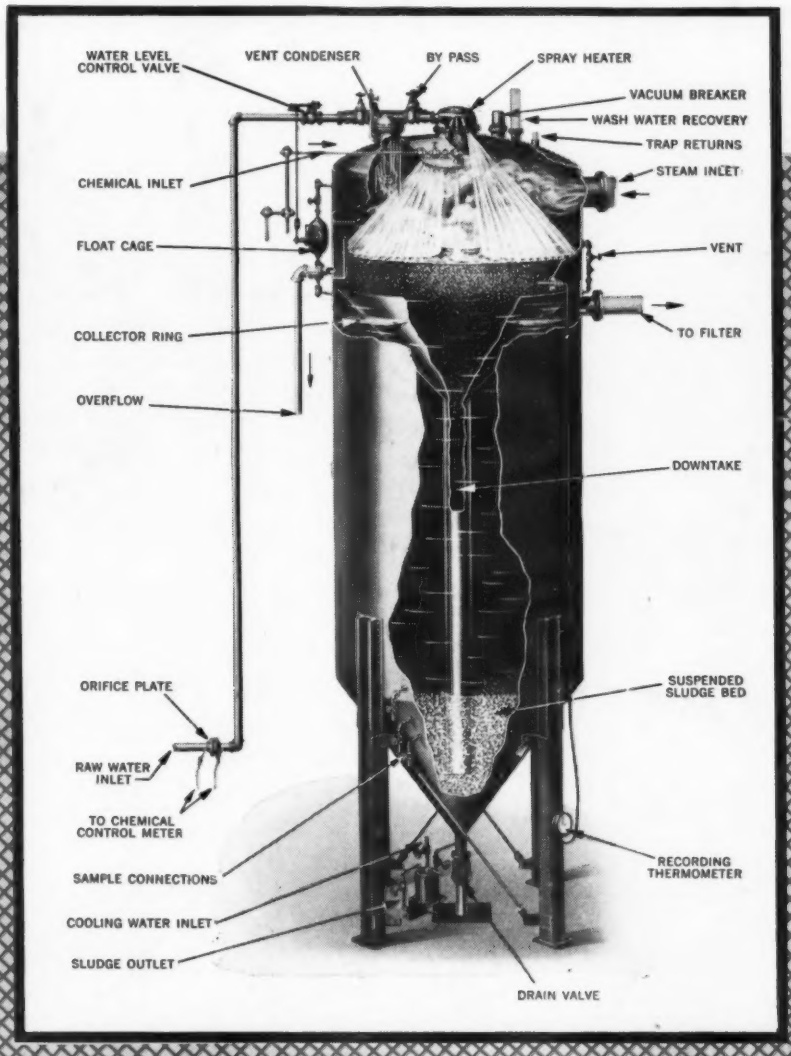

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